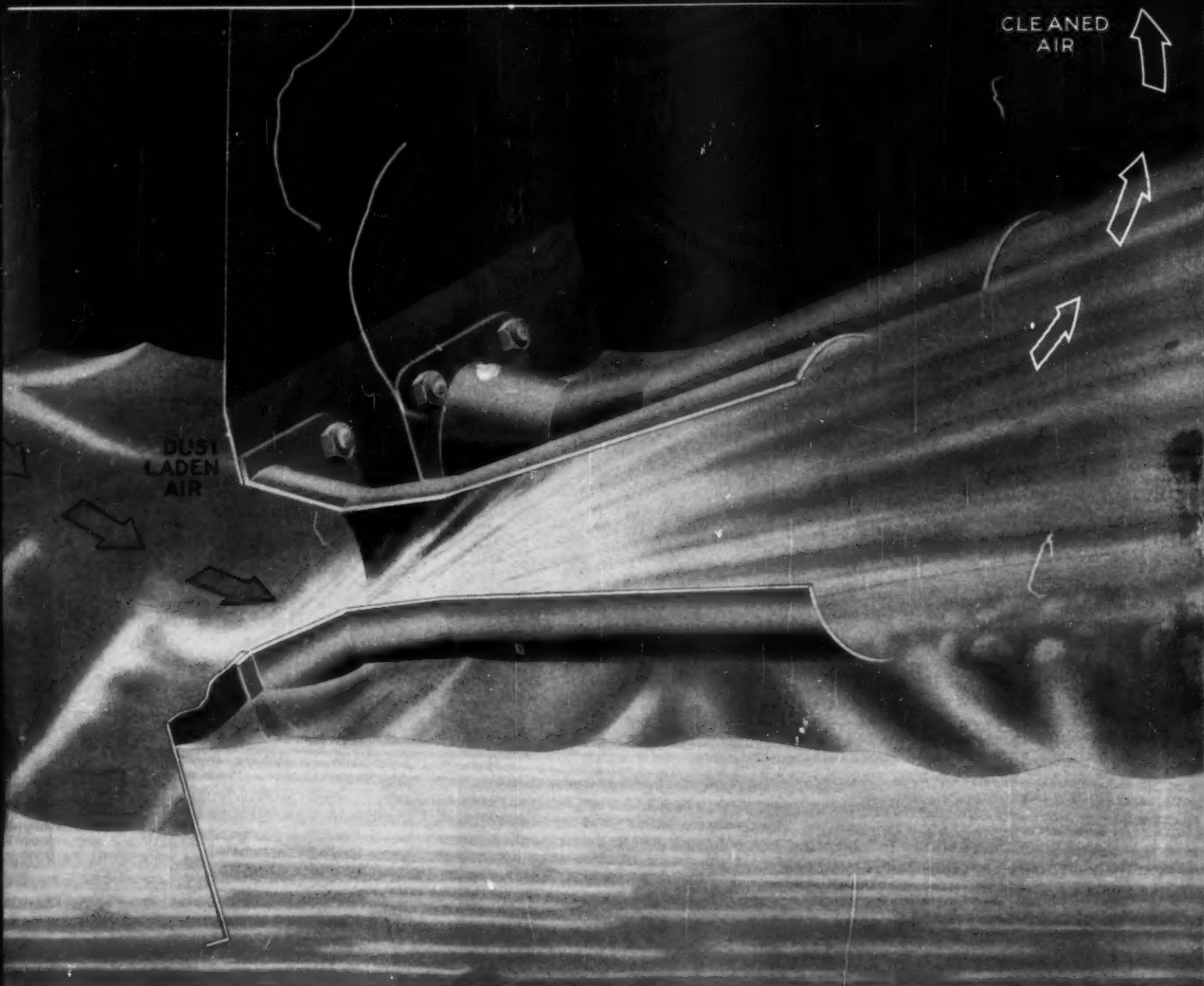
MECHANICAL ENGINEERING

January 1959

In Two Sections • Section One

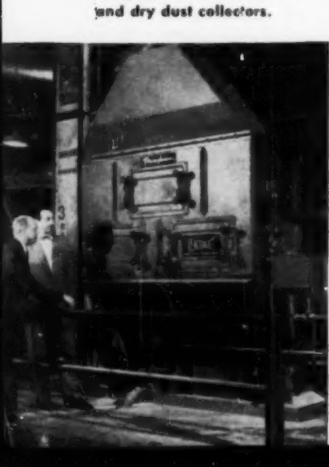
Balloon Astronomy—Target: Mars



Puts the squeeze on difficult dusts

Pangborn Ventrijet Wet Dust Collector uses exclusive venturi tubes for peak efficiency

Pangborn Ventrijet Wet Dust Collector on the job. This is just one of Pangborn's comprehensive line of wet and dry dust collectors.



That pinch-necked venturi tube is the secret behind Pangborn Ventrijet performance. As dust-laden air flows through these tubes, the constriction creates a low-pressure area which draws water into the air stream. The resulting turbulence breaks the water into particles which actually *wash* the dust from the air. The simplicity of Ventrijet design saves money in its ease of installation, its low cost of operation and maintenance.

Although the Ventrijet is particularly suited to collecting hot, moist, inflammable, corrosive and obnoxious dusts, the Pangborn engineering it typifies is important to *any* dust-producing plant. It is not enough to put a dust collector within a plant. An efficient dust control system must be *scientifically* planned, designed and constructed to handle effectively a specific dust problem. This thinking is incorporated into every Pangborn proposal.

The Pangborn Engineer in your area will be glad to go to work for you. He is a dust expert *and will discuss your individual problem at no obligation. And, for more information, write for Bulletin 922 to:* Pangborn Corp., *2200 Pangborn Blvd., Hagerstown, Md. Manufacturers of Dust Control and Blast Cleaning Equipment.*

Pangborn CONTROLS DUST

MECHANICAL ENGINEERING

PUBLISHED BY
THE AMERICAN SOCIETY OF
MECHANICAL ENGINEERS

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VOLUME 81 • NUMBER 1 • JANUARY, 1959

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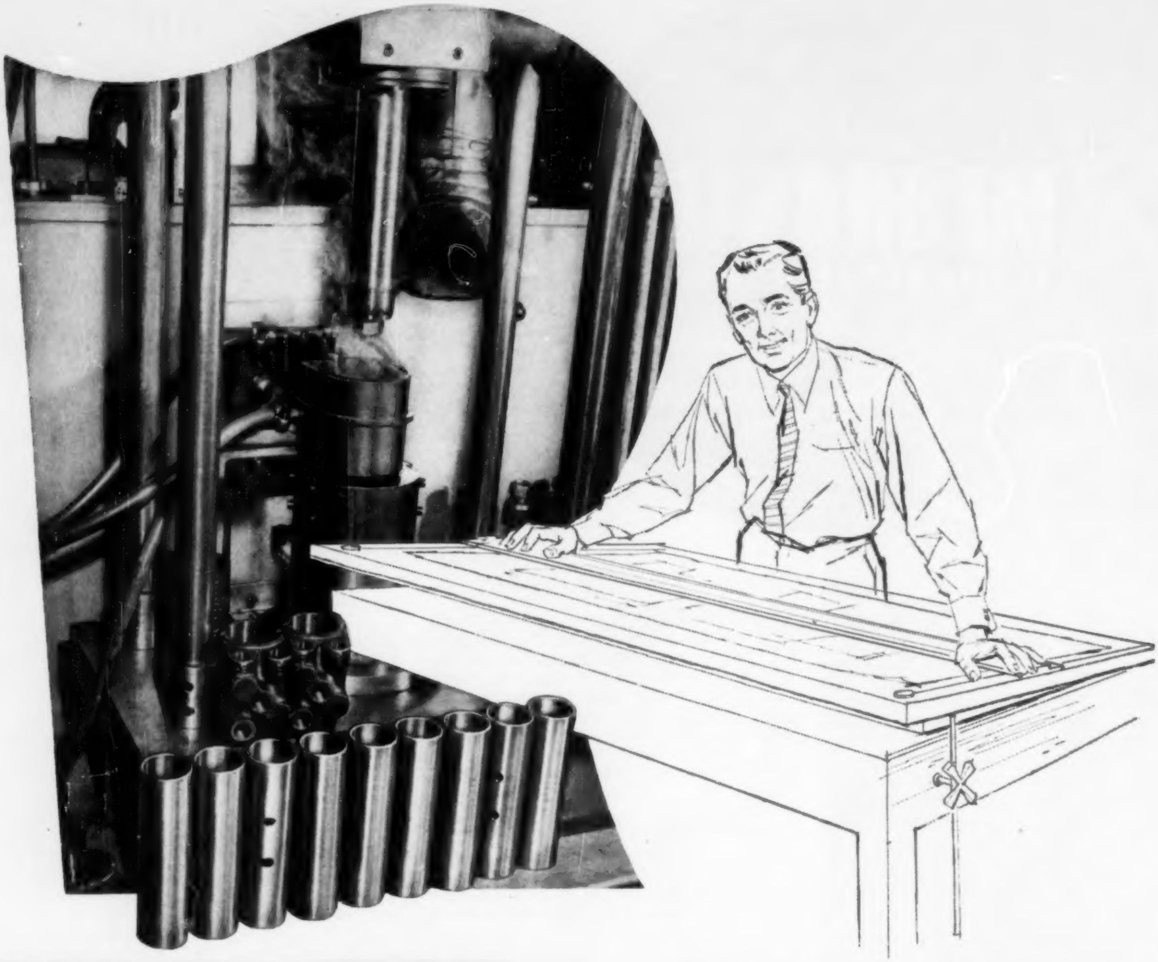

MECHANICAL
ENGINEERING

PUBLISHED BY
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Contents (continued)

VOLUME 81 • NUMBER 1 • JANUARY, 1959

Departments

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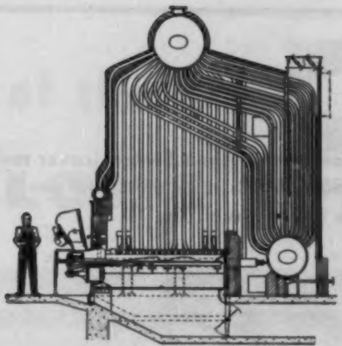
62,000 copies of this issue printed

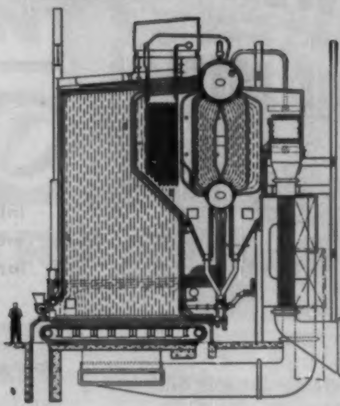
MECHANICAL ENGINEERING
is indexed by the Engineering Index, Inc.

READERSHIP
Eastman
RESEARCH

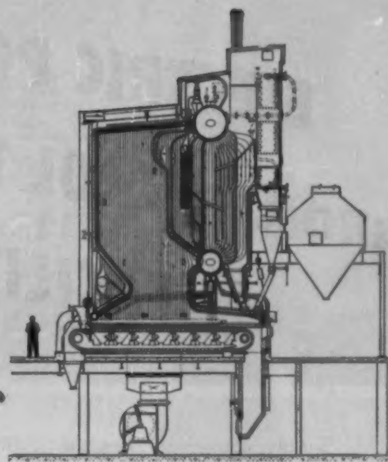
STOKER-FIRED BOILERS*



C-E Vertical-Unit Boiler, Type VU-10 — fired by a C-E Underfeed Stoker, Type E — VU-10 Boilers are available for capacities from 10,000 to 60,000 lb of steam per hr with pressures to 475 psi; superheat to 200 F in larger sizes. Also can be equipped with C-E Spreader Stokers, dump grate type.



C-E Vertical-Unit Boiler, Type VU-40 — fired by C-E Spreader Stoker, continuous discharge type — A baffleless boiler with capacities ranging up to about 300,000 lb of steam per hr, with pressures to 1,200 psi; temperatures to 950 F

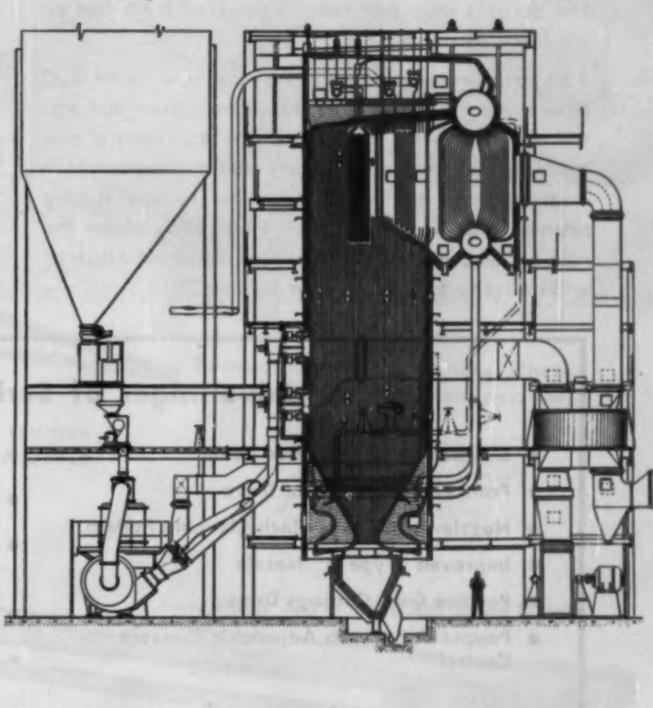


C-E Vertical-Unit Boiler, Type VU-50 — fired by C-E Traveling Grate Stoker — Units of this design are suitable for capacities up to about 150,000 lb of steam per hr; pressures to 1,200 psi; temperatures to 950 F.

BOILERS

equipment of firing

PULVERIZED COAL FIRED BOILERS*



C-E Vertical-Unit Boiler, Type VU-40 — using C-E Raymond Bowl Mills and Horizontal Burners — Capacities up to 600,000 lb of steam per hr, pressures to 1,200 psi, temperatures to 950 F.

These drawings are a few examples of the many units available for coal firing: all are readily adaptable to oil or gas firing.

COMBUSTION ENGINEERING

C-E

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

C-137

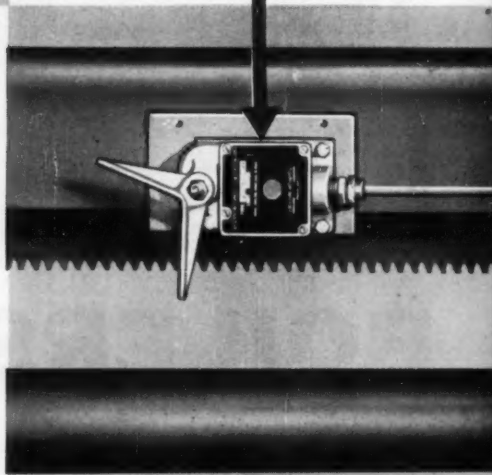
Canada: Combustion Engineering-Superheater Ltd.

PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

ELECTRIC POWER and CONTROL TERMINAL FACILITIES

ANOTHER

Inboard Travel Limit Switch (cover removed). Switch near other end limits lance return travel.



Control for air operation is also simple, compact, accessible and dependable.

Simple, convenient, rugged . . . the electric power and control center of the new Series 300 IK contributes substantially to the dependable, trouble-free operation of this blower. Terminal facilities and the control assembly are concentrated in a cast aluminum box at the drive end. No internal field wiring is required; the blower is completely wired at the factory. The control is linked directly to lance travel and is governed by two durable snap switches . . . actuated by a cam on the lance carriage.

Additional important features of the new Series 300 IK are listed in the panel below. Check them and you will understand why this blower is establishing a new standard of efficiency, economy and dependability in cleaning those heating surfaces that require a long retracting blower. For further information about the new Series 300 IK, ask the nearest Diamond office or write directly to Lancaster for Bulletin 2111.

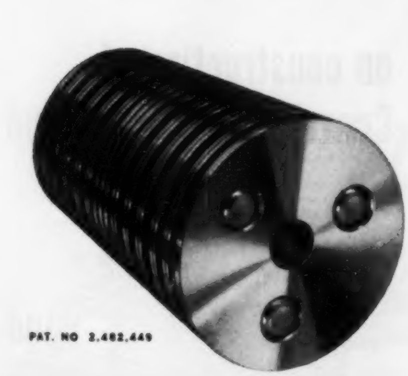
Other Advantages of Series 300 IK Blowers

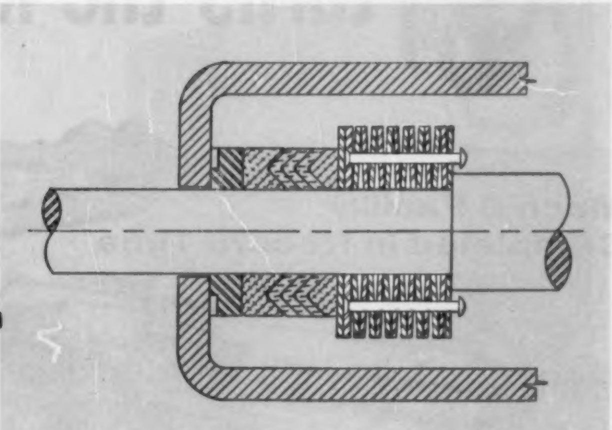
- Backbone and Protective Cover
- Front End Single-Motor Drive
- Nozzle-Sweep-Every-Inch Cleaning Pattern
- Improved "Type A" Nozzle
- Positive Gear Carriage Drive
- Poppet Valve with Adjustable Pressure Control
- Positive Mechanically Operated Valve
- Single Point Outboard Suspension
- Oversize Lance (Step-Tapered for Extra Long Travel)
- Auxiliary Carriages for Extra Long Travel
- Designed for Quick, Easy Servicing

No other Blower gives you ALL THESE ADVANTAGES

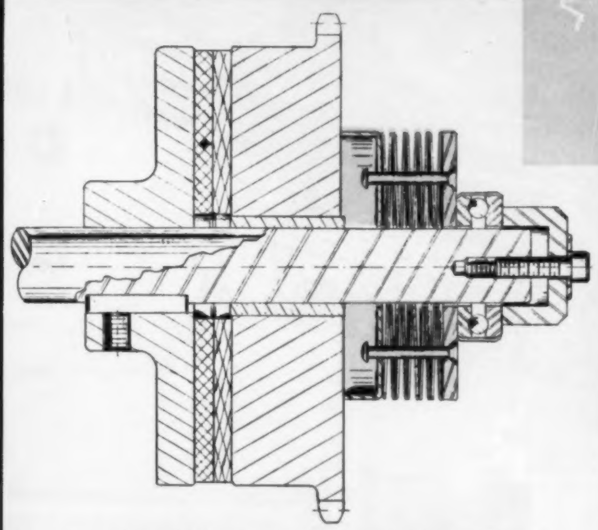
Diamond

DIAMOND POWER





Typical installation of a "cartridge" of multiple Belleville washers in a shaft seal.



Typical installation of a "cartridge" of multiple Belleville washers in a clutch, such as in a machine tool drive.

Some uses of Belleville Washers as a spring ENERGY CARTRIDGE

Where loads are high, operating space limited, and conventional spring forms fail to qualify, Belleville washers in the form of an Energy Cartridge can be a welcome solution. Two such conditions are illustrated here.

By preassembling the washers in a single compact unit held together by pins or posts, installation is simplified and error is prevented in stacking loose washers in sequence. For varying loads, many combinations are available: in series, parallel or parallel series.

Belleville washers may be used for vibration isolation, as spring mountings for punch and impact presses, or to maintain constant pressure. For further information, write for pamphlets "Belleville Springs" and "Energy Cartridge." For engineering and production assistance on large or small requirements, contact the nearest A.S.C. Division listed below.

Associated Spring Corporation

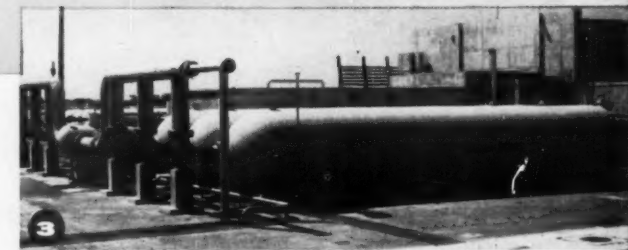
General Offices: Bristol, Connecticut

Wallace Barnes Division, Bristol, Conn. and Syracuse, N. Y.
B-G-R Division, Plymouth and Ann Arbor, Mich.
Gibson Division, Chicago 14, Ill.
Milwaukee Division, Milwaukee, Wis.
Raymond Manufacturing Division, Corry, Penna.
Ohio Division, Dayton, Ohio
F. N. Manross and Sons Division, Bristol, Conn.
San Francisco Sales Office, Saratoga, Calif.
Seaboard Pacific Division, Gardena, Calif.
Cleveland Sales Office, Cleveland, Ohio
Dunbar Brothers Division, Bristol, Conn.
Wallace Barnes Steel Division, Bristol, Conn.
Canadian Subsidiary: The Wallace Barnes Co., Ltd., Hamilton, Ontario and Montreal, Quebec

5812

CB&I turns the key on construction of Convair Supersonic Wind Tunne

Mach 5 Facility Completed in Record Time



CB&I specialists, working in cooperation with *Flui Dyne* Engineering Corporation, handled the engineering, fabrication and assembly of this country's first "turn-key" supersonic wind tunnel. Built for Convair Division of General Dynamics Corporation, the intermittent *blow-down* type tunnel is capable of simulating speeds that range from Mach 0.5 to 5 (five times the speed of sound).

This $3,500,000 project for Convair is one of several supersonic test facilities in which the coordinated facilities of CB&I are playing a major role. These same engineering, fabrication and erection services can provide *you* with the benefits of *one source craftsmanship in steel*—with which CB&I has served industry, science and government for almost seven decades. Write our nearest office for a copy of the *Convair Story*.

E67C8

1. F-106 A Delta Dart, supersonic all-weather interceptor being manufactured by Convair for the United States Air Force.

2. Sketch shows major components of CB&I-built 3,700 MPH wind tunnel at Convair plant, San Diego, California.

3. Six CB&I-built tanks store air at 600-psi for intermittent blow-down type tunnel.

4. Tunnel "throat" or nozzle is comprised of flexible plates to generate flow from Mach 1.6 to 5—was precision assembled to few thousandth of an inch accuracy.

CB&I

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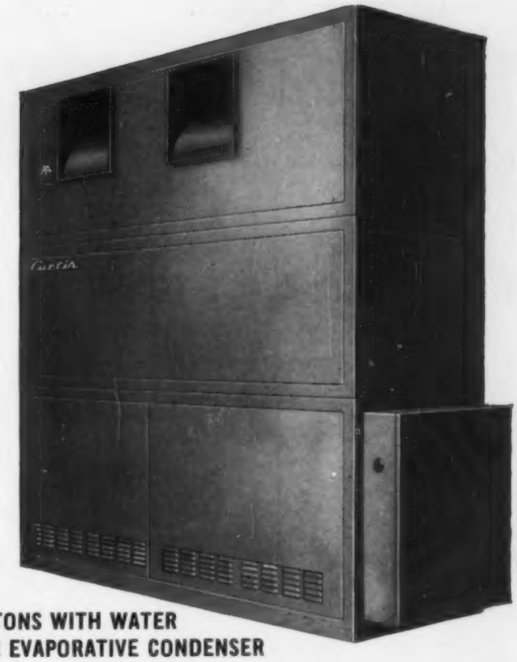
PACKAGED AIR CONDITIONING

INSTALLATION EASIER: Line assembled at the factory —eliminates expensive field labor.

PERFORMANCE KNOWN: Curtis units are run-in at the factory and guaranteed to deliver their rated tonnage. Assures a BALANCED SYSTEM.

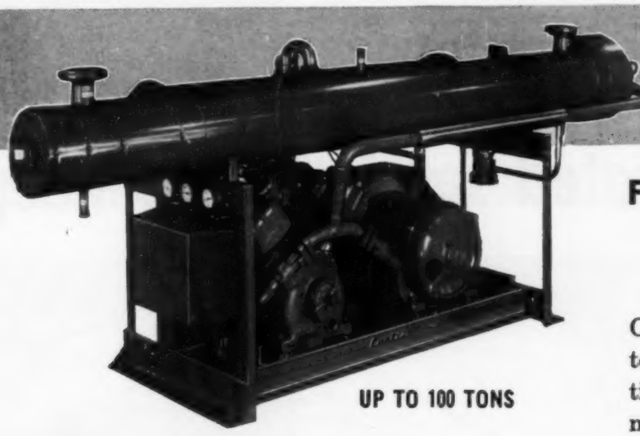
SUPERIOR EQUIPMENT: Long life, quiet, trouble free, economical operation.

DELIVERY ON TIME: Curtis can meet your delivery requirements, a decided advantage over multiple supplier delivery promises!



UP TO 100 TONS WITH WATER COOLED OR EVAPORATIVE CONDENSER

PACKAGED LIQUID CHILLERS



UP TO 100 TONS

For Air Conditioning Process Cooling Refrigeration

Curtis packaged liquid chiller lends itself to a widely diversified field of applications—air conditioning, refrigeration and a multitude of process cooling procedures. Available in capacities up to 100 tons.

REMEMBER, you can count on

Curtis

OUR 104TH YEAR

MANUFACTURING COMPANY • REFRIGERATION DIVISION

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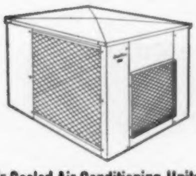
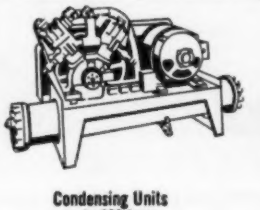
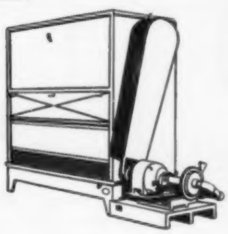
VISIT BOOTH 802
Heating & Air Conditioning Exposition
PHILADELPHIA
Jan. 26-29, 1959
•
See our newly designed packaged air conditioners and liquid chillers



Air Cooled Air Conditioning Units, 3-5-7½ tons. Residential and commercial application.

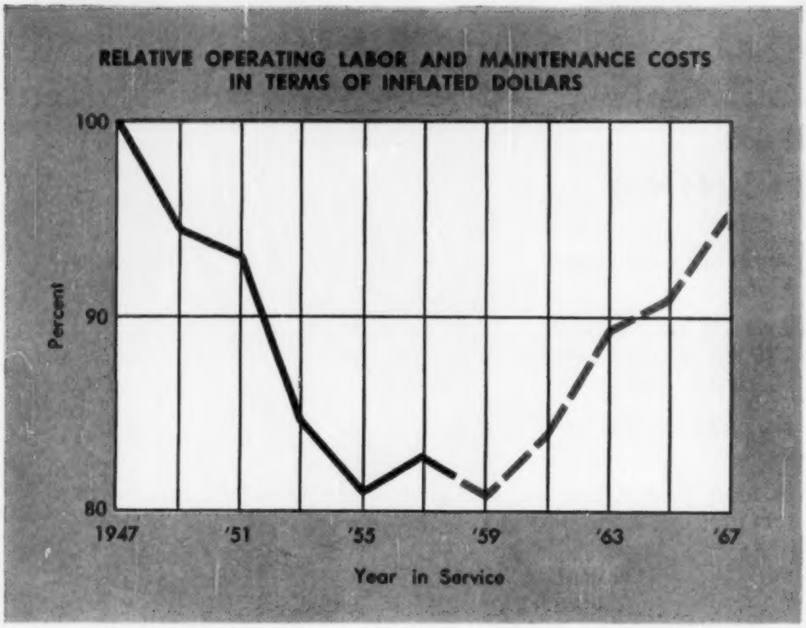


Condensing Units up to 100 tons.



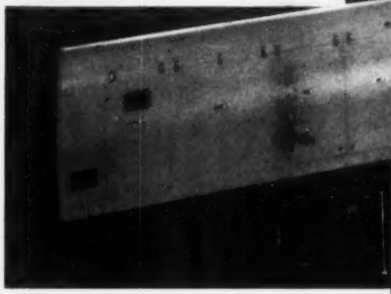
Cooling towers and evaporating condensers, air handling units to match.

C-33

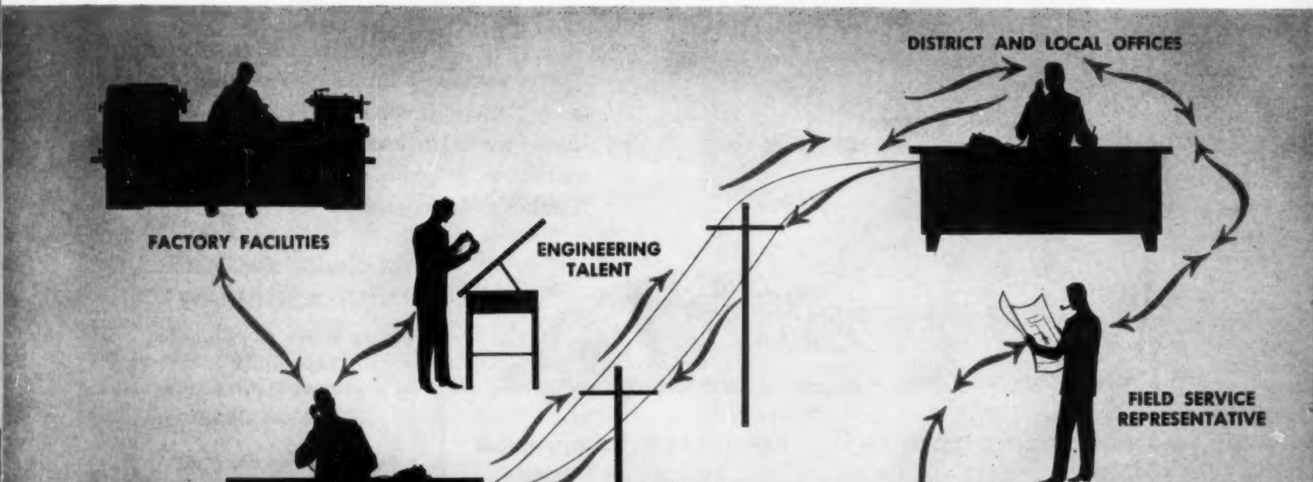


LARGER UNIT SIZES and improved heat rates have helped utilities reduce operating labor and maintenance costs. However, if these costs are projected at the 1947–57 inflationary rate, this trend will be reversed as indicated above. Accordingly, General Electric is constantly strengthening all phases of its present intensive efforts that help in *KEEPING POWER MAKERS ON THE LINE,* thereby promoting even more economical generation of electricity.

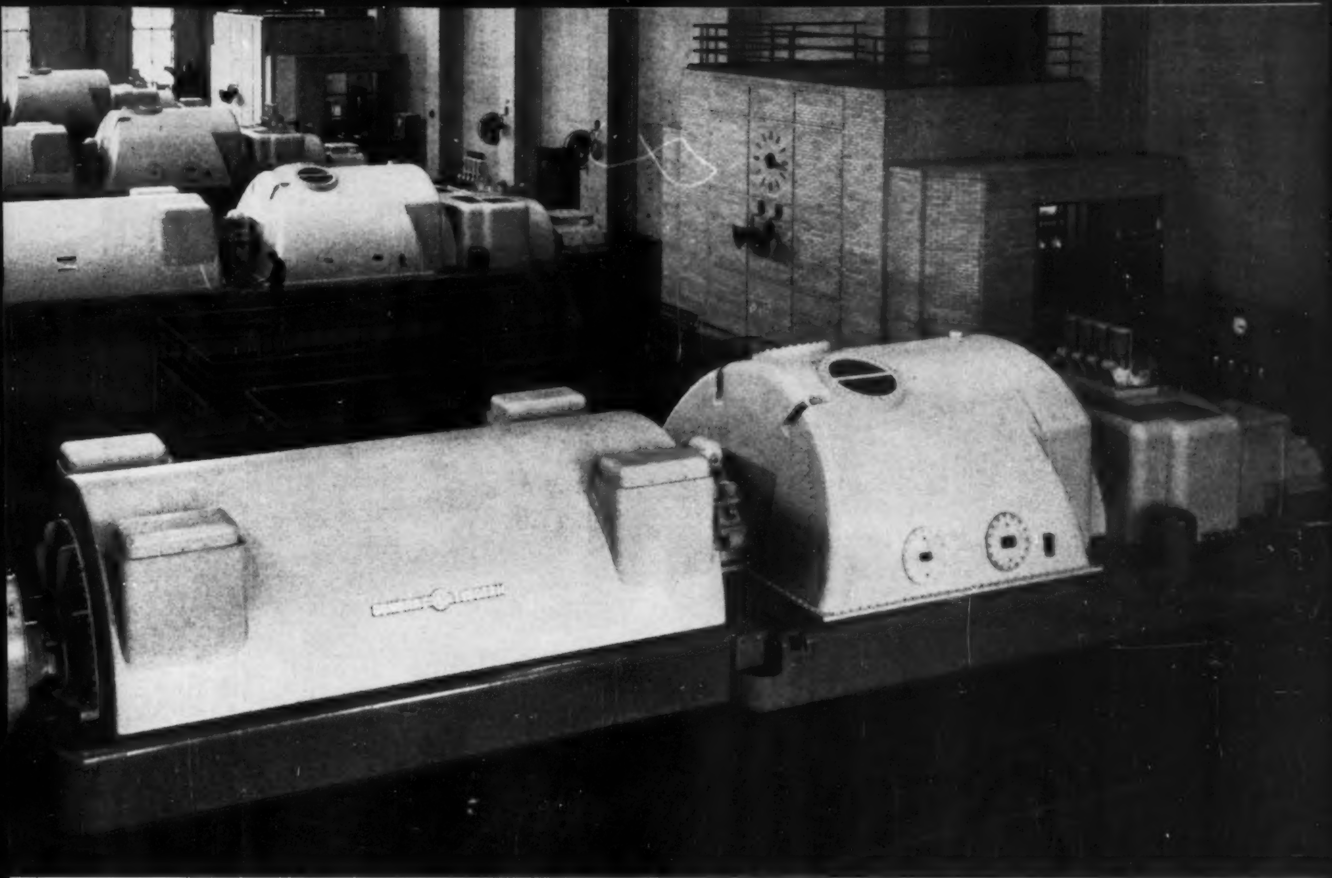
KEEPING POWER MAKERS ON THE LINE, operating at top efficiency is the job of over 400 G-E turbine-generator field representatives backed by well-rounded district organizations, and by complete manufacturing facilities and engineering talent at the factory. Pictured here are four General Electric units installed at the Albany Steam Station, Niagara Mohawk Power Corporation.

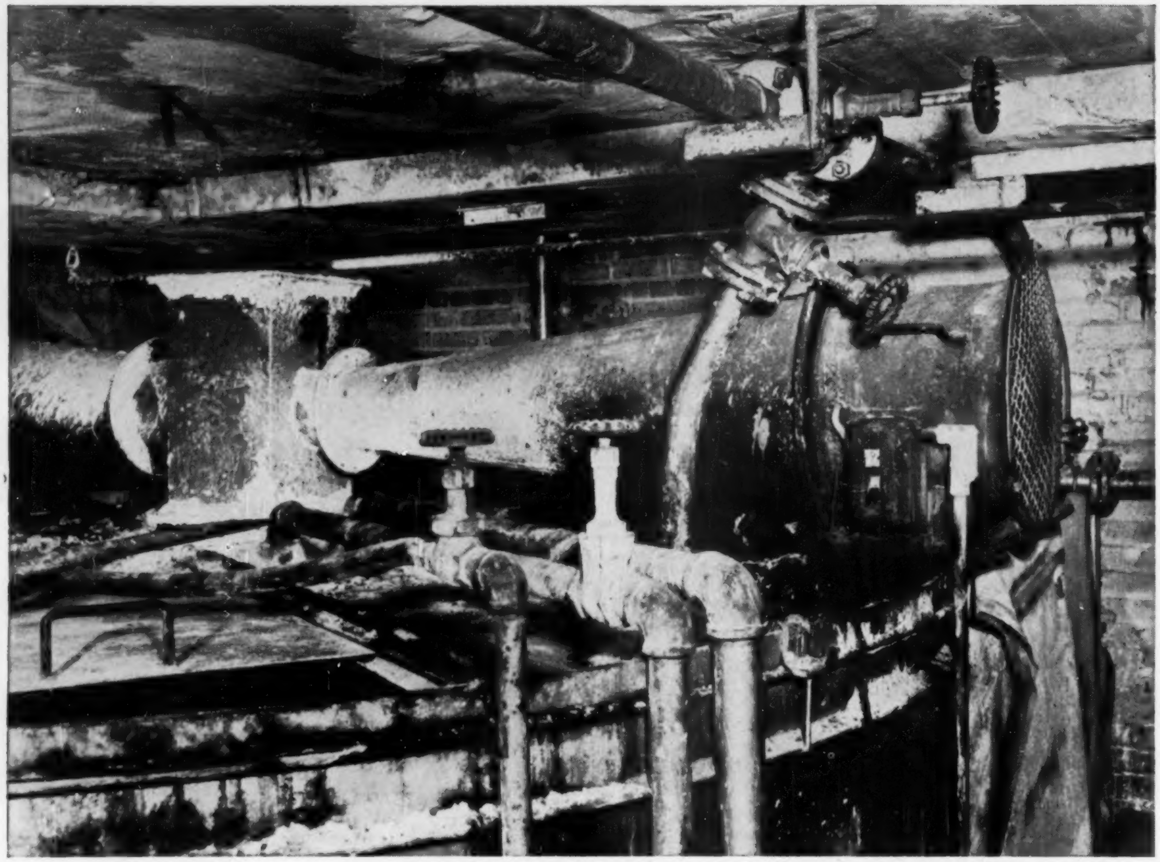


Completely integrated service helps keep



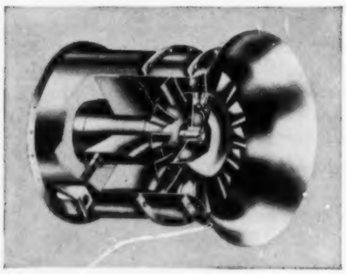
TWO-WAY FLOW OF SERVICE INFORMATION through the Product Service component enables factory "know-how" to supplement the efforts of your field service representatives, and permits design and manufacturing specialists to take full advantage of field operating experiences.





Efficient Joy Axivane Fans vent corrosive fumes from tanks in chemical plant producing fatty acids and polyesters.

CORROSIVE ATMOSPHERE NO PROBLEM FOR THIS JOY AXIVANE® FAN



Other Bulletins also available:
Compressors 268C-80B
Dust Collectors 267D-80B

Joy Axivane Fans are used to vent extremely corrosive fumes in a number of electroplating and chemical plants across the land. Efficient, quiet, compact and durable Joy Axivane Fans are available in alloy steels or with special coatings to resist the most corrosive atmospheres.

Hundreds of standard models are available with either V-belt or integral drive. They are supplemented by a design service which will give you Joy Axivane Fans with whatever efficiency, capacity or pressure your installation requires.

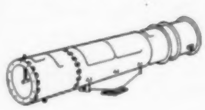
For details write for Joy Fan Bulletin 268F-80B.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited; Galt, Ontario.

WSW 17365-268

JOY ... EQUIPMENT FOR INDUSTRIAL PLANTS ... FOR ALL INDUSTRY

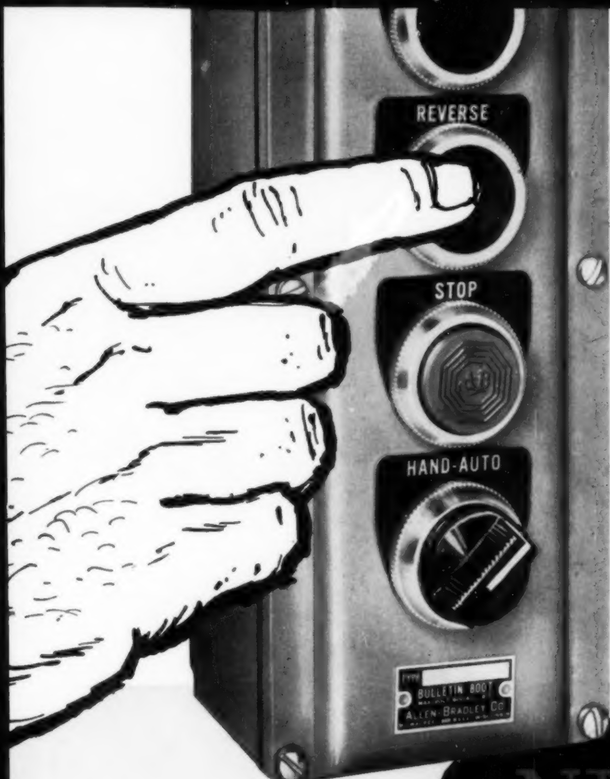
INDUSTRIAL COMPRESSORS



DUST COLLECTORS

ELECTRICAL CONNECTORS

FANS AND BLOWERS



A-B Reliable Control Units

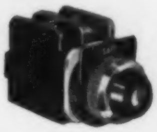
for every industrial application

Among the many hundreds of Allen-Bradley push button and control units, you are certain to find the types best suited to your particular needs. The seven units shown below are a few of the latest additions to the Allen-Bradley *quality* line of control units.

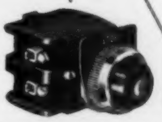
All Allen-Bradley control units—standard duty, heavy duty, and oiltight—have double break, silver alloy contacts—to assure reliable operation. Simple constructions and generous wiring room are outstanding features. Insist on Allen-Bradley control units for *all* of your equipment—you can't go wrong!

NEW

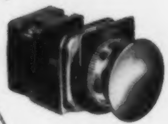
Illuminated Push Button. Combines pilot light and push button in one unit. Oiltight Bulletin 800T.



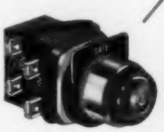
Encapsulated Pilot Light. Oiltight Bulletin 800T.



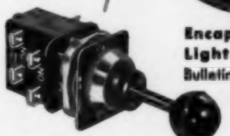
Encapsulated Pilot Light. Heavy Duty Bulletin 800.



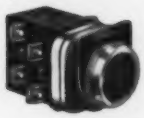
Time Delay Push Button. Delay is adjustable from 0.5 second to 5 seconds. Oiltight Bulletin 800T.



Push-to-Test Pilot Light. Oiltight Bulletin 800T.



Four-way or Two-way Selector Switch. Oiltight Bulletin 800T.



Double Circuit Push Button. Has 2 N.O. or 2 N.C. contacts. Oiltight Bulletin 800T.

ALLEN-BRADLEY OFFERS the most complete line of standard duty, heavy duty, and oiltight control stations on the market. Send for Publication 6090 today.

1-59-MR

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

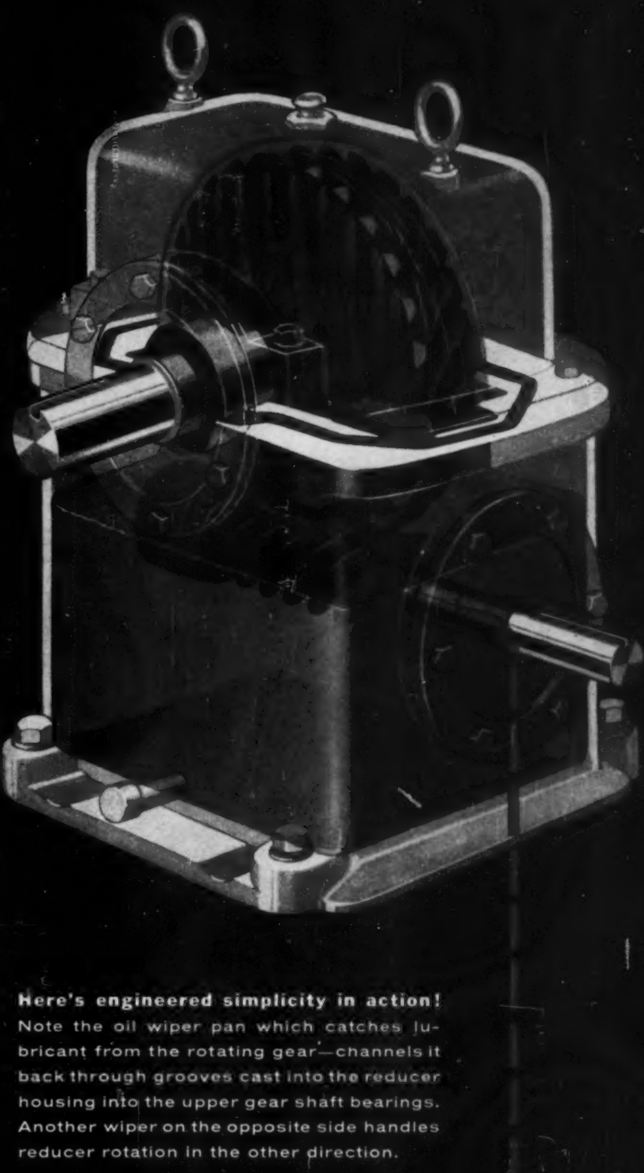
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Automatic, built-in lubrication helps give Clevelands their long service life

Here's one reason why many Cleveland Worm Gear Speed Reducers have provided trouble-free operation day in-day out for over 42 years.

The secret is continuing, adequate lubrication of Cleveland's case-hardened steel worms meshing with low-friction bronze gears. If reservoir is kept filled with good, clean oil, lubrication can never fail.

To get the complete "Cleveland Story", ask for your free copy of our new Bulletin 145. The Cleveland Worm & Gear Company, 3264 East 80th Street, Cleveland 4, Ohio.



Here's engineered simplicity in action! Note the oil wiper pan which catches lubricant from the rotating gear—channels it back through grooves cast into the reducer housing into the upper gear shaft bearings. Another wiper on the opposite side handles reducer rotation in the other direction.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Worm Gear
Speed Reducers

MECHANICAL ENGINEERING

VOLUME 81 • NUMBER 1 • JANUARY, 1959

Charles F. Kettering and Harold V. Coes

Editor, J. J. JAKLITSCH, JR.
Editor Emeritus, GEORGE A. STETSON

The American Society of Mechanical Engineers has recently lost by death two of its most distinguished members, Charles Franklin Kettering, on November 25, and Harold Vinton Coes on December 4, 1958. Their activities and their talents lay in different areas of mechanical engineering. Each earned high distinctions in his own field. Each led a long and useful life. Each spoke with conviction and authority. Each was admired and respected by hosts of friends and colleagues.

Charles Franklin Kettering, ASME Medalist in 1940 and John Fritz Medalist in 1944, was born on August 29, 1876. From his earliest youth he was interested in natural phenomena and displayed inventive tendencies. Poor eyesight delayed the completion of his college course at The Ohio State University until 1904. His interest in those early years was in the telephone and he had much practical experience in that field. But upon graduation, at the suggestion of Colonel E. A. Deeds, he was employed on the inventions staff of the National Cash Register Company at Dayton, Ohio. Here he developed the electrified cash register, the OK Charge Phone and a simple printing register, and originated an accounting machine.

By 1908 Kettering's interests had turned to improvements in automobile-engine ignition systems which he and his colleagues, under the name of Dayton Engineering Laboratories Company, had developed in Colonel Deeds' barn. He had convinced Henry M. Leland, president of Cadillac and a Member of ASME, of the practicability of his scheme and had obtained from him a contract for 8000 battery-ignition sets. In 1910, Byron T. Carter, manufacturer of the Carter Car, broke his jaw while cranking a stalled automobile. Leland, one of Carter's friends, told Kettering that if he could develop a successful self starter the device would be used in all of next spring's Cadillacs. Kettering and his colleagues delivered such a starter to Leland on February 17, 1911, and received an order for 12,000 units to go into all 1912 Model Cadillacs. With storage battery and a generator on the Cadillac for ignition and starting, an electric lighting system was next devised. Delco (the name of the company suggested by one of the colleagues and coinventors of the ignition system, W. A. Chryst, Mem. ASME, who died on June 4, 1958) was now a manufacturing business while its founders wished to continue in research and development. Hence, Delco was sold to what is today General Motors Corporation, and Kettering, as a result of negotiations with Alfred P. Sloan, Jr., was free to devote his time and talents to research under certain conditions—that a new Research Laboratory be established at Dayton, that "I would have no responsibility and no authority, and that I would never be held accountable for the money I spent—the minute you take responsibility or authority you quit researching. You can't keep books on research—." In January, 1920, Kettering became a vice-president of General Motors and in December of the same year, a director. He served for 27 years, when he "retired"—if a man with such vital interest in everything that comes to his attention can ever retire.

This single facet of an extraordinary career must suffice to indicate the restless inquiring mind that probed everywhere relentlessly and stimulated hundreds of other minds conditioned for research and inventive pursuits. An authentic and readable biography of the man was published in 1957 by T. A. Boyd, "Professional Amateur," and in it the reader finds many characteristic quotations, familiar to persons who have heard Kettering speak, and an appreciative account of the achievements of a full and active life.

Harold Vinton Coes was born June 21, 1883, and was graduated from the Massachusetts Institute of Technology in 1906, the year that Frederick Winslow Taylor, the great pioneer in scientific management, was President of ASME. Coes joined the Society as a Junior Member in 1907, became a Member in 1913, a Fellow in 1936, President in 1943, and was made an Honorary Member in 1950.

His work began and continued in the fields of management and industrial engineering and he was frequently referred to as a doctor for sick companies.

In 1906 Mr. Coes became assistant to the factory engineer of the Western Electric Company. From 1908 to 1911 he was assistant to the president of the Liquid Carbonic Company, Chicago, Ill. He then became manager of the Chicago office of Lockwood, Green and Company of Boston, after which he served as vice-president and general manager, Sentinel Manufacturing Company, New Haven, Conn. He then joined the staff of Gunn, Richards and Company, Industrial Engineers, New York, and in 1917 became a member of the staff of Ford, Bacon and Davis, Inc., New York.

From 1924 to 1928 Mr. Coes served as vice-president and general manager of the Belden Manufacturing Company, of Chicago, Ill., after which he returned to Ford, Bacon and Davis where he organized its department of industrial management. For that firm he served as executive vice-president and director, Vulcan Iron Works, in 1937. He became a partner in 1937, and vice-president in 1941, and in 1943 a director of the firm. For Ford, Bacon and Davis he was involved in the design of munitions plants in World War I and was acting general manager of the Platt Iron Works, Dayton, Ohio, where the famous Whippet tank was manufactured. A few years prior to his retirement, in 1948, Mr. Coes went to India as a consultant to the Planning and Development Department of the Government of India.

Mr. Coes served ASME in many capacities from 1909 to the day of his death. He also was a member of the Advisory Committee, College of Engineering, Princeton University, and chairman of the Advisory Committee of the Industrial Engineering Department, Columbia University, in 1951. Retirement provided him opportunity for travel and to serve as deputy director and acting director of the Industrial Division, Economic Cooperation Administration, in Paris, 1949.

Of his numerous interests in the engineering profession, his activities in fields of industrial management and administration led him into the work of the American Management Association, of which he was a past-chairman of the Finance Committee. He was a past-chairman (1932–1934) of the Institute of Management; past-president of the Association of Consulting Management Engineers; vice-chairman of the Finance Committee of the Seventh International Management Congress. In 1945–1946 he was president of the Montclair Society of Engineers; and was a member of the Society for the Advancement of Management, the American Arbitration Association, and the Army Ordnance Association. He served as a member of United Engineering Trustees, Inc., from 1930–1936, and was its president, 1933–1935.

Whenever and wherever the practical affairs of businesses or of the many societies to which he devoted a large portion of his time were under discussion, Mr. Coes could be counted on for forthright, common sense, and down-to-earth advice and opinions. His manner on such occasions was earnest and sincere. His long and varied experience in the field of management lent authority to his opinions and confidence in the soundness of his judgments.—*G. A. Stetson*

Journal of Heat Transfer

Even before the new plan to split Transactions of the ASME into a series of four quarterlies could be implemented, an urgent need for a fifth quarterly has arisen. Thus, in addition to the *Journals of Basic Engineering*, *Engineering for Power*, *Engineering for Industry*, and *Applied Mechanics*, a *Journal of Heat Transfer* is being added commencing in February.

The engineering science of heat transfer has, in recent years, experienced a rapid growth. And a significant portion of this activity has been centered in the Heat Transfer Division of ASME. In fact, the publication space allocated to high-level technical papers processed by the Heat Transfer Division in 1957 reached a total of 509 pages or about 25 per cent of the Transactions space.

Since heat-transfer material was originally assigned to the *Journal of Basic Engineering*, the *Journal of Heat Transfer* will be provided without additional cost to member subscribers of *Basic Engineering* for fiscal 1958–1959; after which period it will be placed on a separate subscription basis as are the other four journals in the Transactions series.

Once again, therefore, ASME has recognized a need to satisfy the technical interests of a vital segment of Society activities—Heat Transfer—and has moved rapidly to satisfy that need by providing a publication outlet for it—a *Journal of Heat Transfer*.—*J. J. Jaklitsch, Jr.*

Engineering Unity and the LOCAL COUNCIL

By J. N. Landis

Retiring President,

The American Society of Mechanical Engineers

In his speech at the President's Luncheon, J. N. Landis, outgoing President of the ASME, reports on his primary objective, the unity movement. Local engineering councils foster unity among engineers.

THE subject to which I have addressed my principal effort during the past year has been what is designated as the unity movement in the engineering profession. I have spoken on this subject both at local section meetings and at meetings of the Council. However, the following remarks will relate to a new angle of the subject.

I do not know to whom can be credited the first suggestion of a national unity organization for engineers. It may be that some leader in our first engineering Society, the American Society of Civil Engineers, should be given this credit.

An Idea Is Born

The first written record I have found of anyone fostering an American engineers' unity movement relates to William Kent, who was one of ASME's Charter Members. Kent in 1886 addressed the American Association for the Advancement of Science. He proposed an Academy of Engineering composed of Army, Navy, civil, mining, mechanical, sanitary, and electrical engineers, selected out of members of not less than five years' standing in the existing societies. The stated object of the Academy was to bring into closer relations the members of the various branches of the engineering profession.

It will be interesting to you that, in the scheme of organization suggested in Kent's proposal, the big societies of civil, mining, and mechanical engineers were each to be allowed five academy members for every two academy members from the little electrical-engineering society. As a commentary on how rapidly change occurs in human affairs, today the American Institute of Electrical Engineers has grown to be the largest engineering society, and the National Society of Professional Engineers, which did not come into existence until 48 years after Kent's talk, has in only 24 years grown to be the second largest society.

By engineering unity most engineers mean an organizational arrangement of engineering societies with some appropriate name, such as American Engineering Association, which would receive the same general recognition by the public as the name American Medical Association has for doctors and the name American Bar Association has for lawyers. Some engineers advocate accomplishing this through a federation of the many existing technical and professional engineering societies. A few others advocate trying to create one single all-embracing society.

Address delivered at the President's Luncheon during the Annual Meeting, New York, N. Y., Nov. 30–Dec. 5, 1958, of The American Society of Mechanical Engineers.

Engineering Unity

Unity Does Exist

From the fact of so much talk about the desirability of securing unity in the profession, the uninformed layman would think the engineering profession consists merely of a great many separate societies working exclusively in an independent fashion. This is contrary to the facts, as we do have a great deal of unified action in the profession. We have the Engineers Joint Council, made up of representatives of leading societies, which functions to co-ordinate technical and professional affairs of the member societies. This agency comes the nearest to being the unity organization of the profession.

We also have Engineers' Council for Professional Development, which functions principally in the educational and accreditation area and is made up of representatives of leading engineering societies. Then we have the National Society of Professional Engineers, which is a great federation of state professional engineering societies and accomplishes unification of those in the profession who hold state licenses to practice engineering and who elect to belong to the Society.

The Local Council

There is still another very important and often overlooked set of agencies promoting unity. I refer to the many strictly local, city, and area engineering councils.

All of the important national engineering societies have local-section organizations in the principal cities and industrial areas. In a great many cities or heavily industrialized areas these local sections have created councils with various forms of government for coordinating their activities and for collective service to their communities. Often these councils, although made up predominantly of representatives of engineer groups, include representatives also of local scientific organizations, but this addition, instead of being harmful, has merely the effect of giving such councils greater value in their communities.

Establishing the Pattern

Much more than people realize, these local councils establish a pattern of unity throughout the profession. In a sense, these local-area councils constitute the grass roots of the engineering unity movement.

Broadly speaking, engineering unity will be fostered by increasing the activity in existing councils and by organizing additional local councils.

I want to urge that where there are existing local councils, these should do all they can to promote activity with renewed vigor. Where a local council does not exist at present, and if there is any thought of creating one, you should take the initiative and bring a council into existence and help its activity until it becomes self-sustaining.

Such councils, dealing predominantly with local problems nearest to the individual members of the many societies, afford an excellent means of serving the purposes of engineers of varied interest working together. Through such local councils, useful opinions will be developed and solutions will be developed to fit the unique local conditions. The solutions decided on can be utilized to the extent most helpful in the limited local areas, and the prestige of engineers will be enhanced in the grass-roots areas.

Engineers on Their Home Grounds

Most certainly the engineering-society problems of a concentrated area like Schenectady differ greatly from the engineering-society problems of an area like Iowa where the technical population is more sparse. A national-level unity activity working out of New York City cannot be of much help to either area, other than as a symbol and as providing a top level sort of guidance. We must have a local-area unity. We do have a great deal of such unity, but I am urging more.

Unity at all Levels

It is my belief that, for the nation as a whole, there is potentially more benefit from the engineering unity arising from the local-area councils than there is at the national level. We want unity at both levels, but we already do have it in a great many places at the local level, and let us make the most of it. In my view, no particular importance attaches to the fact that in local-area councils the type of organization settled on in one place will differ from that settled on in another, and that the emphasis attaching to one particular society or another will vary from place to place. The really important consideration is that we all get ourselves in the same room and begin working together.

Another argument for an increase in local council activity is that this will most certainly help to keep the ball rolling if we should at any time enter a stalemate on the national level.

The Crystal Ball

Now, to a specific suggestion. If the local councils could look into a crystal ball to see how the national level will finally organize itself, it would be generally advantageous if the local councils would shape their organizations similarly. By organizing so as more or less to parallel the expected national pattern, they would fit in with it and would help to influence the establishment of the ultimate national pattern.

A number of us have been looking into the crystal ball. What we see there is the very definite likelihood that, when we do get together, we are going to have an organizational framework which has three major functional divisions. Here I am borrowing from AIEE—tremendous credit should go to the 1956 AIEE Board of Directors for conceiving and focusing the spotlight on what is known as the AIEE Functional Plan. I think that nationally we will soon develop a unity organization which will have a grouping of joint educational activities like Engineers' Council for Professional Development, a grouping of joint technical activities like Engineers Joint Council, and a grouping of joint professional activities such as are embraced by the National Society of Professional Engineers.

If the local councils around the country can begin shaping their organizations in this general pattern we shall be able to work from both ends toward the middle; that is, to work toward better unity from the local level and also from the national level. And what is most important, we shall begin development in the grass-roots areas of better engineer-statesmen for the national engineering-unity organization we so desire.

By F. D. Hoffert,

E. A. Kelly, and

A. M. Squires

Hydrocarbon Research, Inc.,

New York, N. Y.

PETROLEUM TECHNIQUES For STEEL

The "H-Iron" Process is ready for commercial application, bringing petroleum-refining techniques to the steel industry. Oil and natural gas will provide the hydrogen for this new process which presents a challenge to the blast furnace.

For over one hundred years, metallurgical coke has been the basic fuel used in winning iron values from iron ore. Use of petroleum products by iron and steel industries has largely been limited to finishing steps (for example, in open-hearth steelmaking). Many inventors have sought to liberate the steel industry from its dependence upon a supply of good coking coal, and a bewildering variety of iron-ore-reduction schemes has been proposed based upon fuels other than coke. Until recently, the blast furnace, with its high fuel efficiency and its large unit capacity, has been unchallengeable under American economic conditions.

Recent developments have radically changed the picture. Capital costwise, the blast furnace (with its necessary coke ovens and ore-sintering plant) is pricing itself out of the market, while advances in natural-gas and petroleum technology provide basis for a new iron-ore-reduction process of both excellent fuel efficiency and high unit capacity.

The H-Iron Process, developed by Hydrocarbon Research, Inc., in collaboration with Bethlehem Steel Company, is a straightforward application of techniques developed and put to use by the petroleum industry during the past generation. The reducing agent in the H-Iron Process is hydrogen, which of course can be manufactured from a wide variety of fuels.

The new process incorporates standard petroleum-refinery construction practice and processing economies. It is fully competitive with the blast furnace both in fuel efficiency and in unit capacity. More strictly speaking, combination of H-Iron Process with electric steelmaking furnaces provides a challenge to the classical combination of blast furnace and open-hearth furnace as a route to ingot steel. (Only combinations leading to ingot steel can strictly be compared, since the H-Iron Process produces a cold melting stock which still contains earthy impurities present in iron ore, while the blast furnace produces hot metal, molten pig iron, from which earthy impurities have largely been removed.)

Capital cost for steelmaking by combination of H-Iron with electric furnaces is about one half capital cost for new blast furnaces, coke ovens, and open hearths. Operating costs in northeastern United States are comparable for both new and old routes to steel (although of course return on capital is higher for the new route), but operating costs for steelmaking in Texas or other natural-gas-producing States are appreciably lower for the H-Iron-electric-furnace route.[1]

This development is of interest to the oil-and-gas industry, since it provides a potential outlet for petroleum products and may permit refiners to find more economic uses for gases and heavy residues from crude-oil processing.

The Prospect for Hydrogen

Refiners have been alert to opportunities to realize profits by better utilizing fractions which have greater than fuel-gas value (for example, ethylene and other light olefins needed for plastic manufacture). Construction of large numbers of catalytic reformers since World War II has led some refiners to go into ammonia manufacture. It is quite plausible that use of hydrogen

Contributed by the Petroleum Division and presented at the Annual Meeting, New York, N. Y., November 30–December 5, 1958, of The American Society of Mechanical Engineers. Paper No. 58—A-158.

[1] Operating costs for H-Iron manufacture have been presented by A. M. Squires and C. A. Johnson, *Journal of Metals*, April, 1957, pp. 586–590.

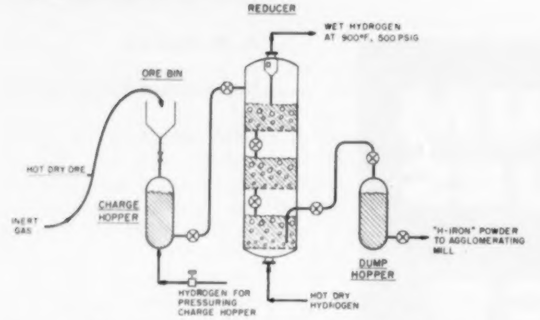


Fig. 1 The flow of solids through the H-Iron Process. A given particle of ore spends 6 hr on the average within the reduction vessel, or about 2 hr in each of the three beds.

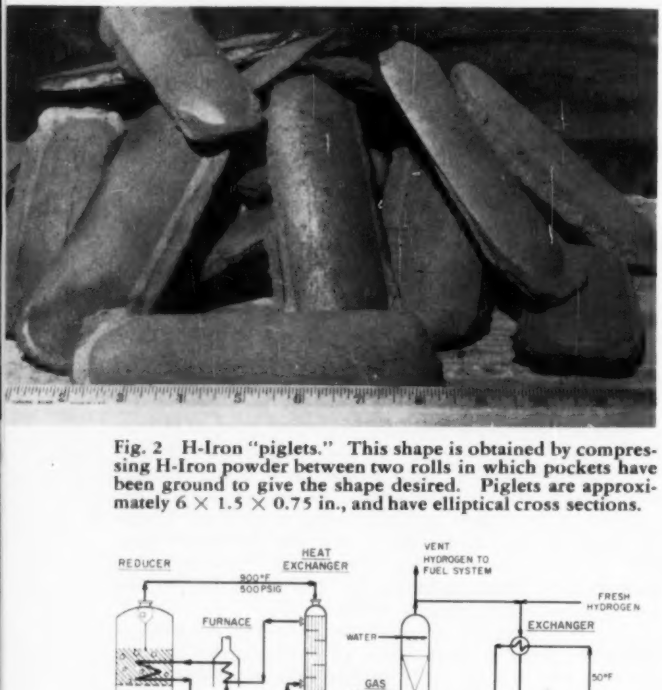


Fig. 2 H-Iron "piglets." This shape is obtained by compressing H-Iron powder between two rolls in which pockets have been ground to give the shape desired. Piglets are approximately 6 × 1.5 × 0.75 in., and have elliptical cross sections.

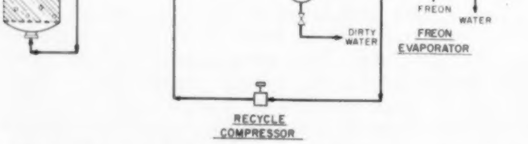


Fig. 3 The flow of hydrogen. Hydrogen is circulated at about 500 psig, and on each pass through the reducer a portion of hydrogen is converted into water. Conversion depends on the ore and reduction desired and varies from 7 to 12 per cent.

for H-Iron may ultimately become greater than use of hydrogen for ammonia.

In recent years, approximately 250 billion cubic feet of hydrogen have been consumed annually in manufacture of about 3.5 million tons of ammonia. Annual pig-iron production has run around 75 million tons. Manufacture of 75 million tons of H-Iron would consume more than 1500 billion cubic feet of hydrogen, and would require over 1000 billion cubic feet of natural gas (for hydrogen manufacture, furnaces in H-Iron circuit, etc.) or the heating equivalent of other fuel. (This is about ten per cent of the present national consumption of natural gas.)

No one imagines that existing blast furnaces will be abandoned for many years to come, but the steel industry must give serious consideration to the combination of H-Iron and electric furnaces for future expansion of steelmaking capacity. Several steel companies are already studying this combination for expansion of steelmaking activities in areas where natural gas is available.

Diversion of existing coke supplies from blast furnaces to hot-blast cupolas melting H-Iron also presents attractive possibilities; in this way, a threefold expansion of hot-metal capacity can be secured without construction of new coke ovens. If the H-Iron Process succeeds in capturing most new iron-making capacity, use of hydrogen for H-Iron manufacture may approach present hydrogen consumption in ammonia manufacture within ten years.

Refiners should find ample opportunities for their enterprise during these developments. The steel industry is accustomed to relatively stable prices for coking coal. Indeed, much coking coal is produced in captive mines, and a deterrent to adoption of H-Iron is reluctance to rely upon fuels which are either interruptible, like natural gas delivered from a pipeline, or volatile in price. Refiners may find steel companies receptive to proposals for long-term contracts for delivery of refinery gases or heavy tars not readily salable elsewhere.

Even more interesting for both refiner and steelmaker may be deals where refiner supplies steelmaker directly with hydrogen across the fence. The latter will thereby gain an appreciable reduction in capital cost of his H-Iron installation, while the refiner may either gain an outlet for catalytic-reformer-by-product hydrogen, or gain a sizable capacity increase in a hydrogen-manufacturing installation needed to supply his refinery with hydrogen for hydrotreating off-specification stocks.

The first commercial H-Iron plant is now under construction at the Alan Wood Steel Company's Conshohocken, Penn., works. This plant will operate in 1959. Additional plants are in the planning stage.

The H-Iron Process

The H-Iron Process requires a charge of iron ore in a powdered form, since reduction is carried out in a fluidized bed.

Ability of the process to handle iron-ore fines is actually, in most cases, an advantage rather than a handicap. Steel industry in recent years has been forced to turn more and more to ores requiring fine grinding to permit beneficiation of iron values. Even where beneficiation is not required, large quantities of iron-ore fines have accumulated incidental to preparation of lump ore from

friable ore bodies. Adoption of the H-Iron Process in most cases will eliminate necessity of an ore-sintering or ore-pelletizing step, and only in rare cases will significant grinding costs be incurred.

Fig. 1 illustrates the flow of solids through the process. Reduction is carried out in several fluidized beds arranged in series to permit countercurrent contacting of ore and hydrogen gas. (The Alan Wood plant has three beds in series in a single reducer vessel.) Ore is fed practically continuously to the topmost bed, and the level of this bed rises gradually during most of the reduction cycle. After an interval, reduced iron powder is dumped from the bottom bed to a dump hopper, with practically complete depletion of inventory of the bottom bed. Thereupon contents of middle bed are dropped into bottom bed, and a portion of upper bed is dropped into middle bed.

It will be recognized that the process meets all practical requirements of a fully continuous process. Flow of hydrogen is not interrupted during any of the charging or dumping operations, and production of water (by reaction of hydrogen with iron oxide) is fully continuous at a practically steady rate. There is a close analogy with operation of a blast furnace, which is also a countercurrent process with continuous flow of gases and intermittent charging of ore and intermittent tapping of molten product.

Dense-Phase Transport

Transfer of ore fines from charge hopper to reducer and transfer of reduced iron powder from reducer to dump hopper are accomplished by "dense-phase transport." Iron-ore fines are first dried and preheated to about 900 F in a rotary kiln or a shaft furnace. Dry, hot ore is transferred pneumatically to a bin located above a charge hopper, which is filled with a batch of ore and then pressured with hydrogen to about 650 psig, providing a pressure differential of about 150 psi between charge hopper and reduction vessel. When valves in the line between hopper and reducer are opened, iron-ore fines flow under this pressure differential at their settled (i.e., bin) density.

(Experiments on dense-phase transport of coal have been reported by workers of the Bureau of Mines.[2] Under the conditions of their experiments, aeration of the coal-charge hopper was required. The present research has determined that no aeration is required to accomplish smooth, reliable transfer by dense-phase transport, provided a rate of transfer is chosen which is sufficiently large.)

In dense-phase transfer, line velocities are low, erosion problems nonexistent, and line capacities extremely high. For example, a Schedule 80, $^3/_4$-in. line has a flow capacity of about twenty tons of iron-ore fines per hr. The reducer vessel remains at full pressure during the transfer, and flow of hydrogen through the reducer is not interrupted.

Reduced iron powder is removed from reducer by dense-phase transfer to dump hopper, and from dump hopper may be sent long distances by dense-phase transfer to an agglomerating mill. Fig. 2 is a photograph of H-Iron "piglets," the currently preferred shape for compacted H-Iron. Piglets jackstraw nicely when charged to a steelmaking furnace, providing a desirable fraction of voids for transfer of heat throughout the charge during early meltdown. Highly successful electric-furnace heats have been conducted in which H-Iron piglets constituted 60 per cent of furnace charge. Piglets have a density of about 5.5, and good strengths have been obtained.

Fig. 3 shows essential features of the hydrogen circulating system. Reducer capacity for iron reduction varies between about four and seven tons of iron per sq ft per day, figures which compare very favorably with the blast furnace. A capacity of 1000 tons per day, or even higher, may practicably be obtained in a single reduction vessel.

The Hydrogen Cycle

Wet hydrogen leaves the reducer at about 900 F and 500 psig and is cooled first by heat exchange against recirculated dry hydrogen, second by direct contact with cooling water, and third by Freon refrigeration. Cooling hydrogen at 500 psig to 50 F serves to remove water to a level of a few hundredths of a per cent by volume.

A portion of the spent hydrogen stream is vented to control concentration of inerts (such as methane, argon, etc.), and make-up hydrogen is added to the circuit. A water-venturi scrubber is used to remove dust carried by gas from the reducer, with final dust clean-up afforded by contact with cooling water. This arrangement for dust removal has proved extremely effective for operation with hydrogen at elevated pressure.

A recycle compressor boosts the stream to overcome pressure losses, and dry hydrogen passes through heat exchanger and a furnace which supplies endothermic heat of the reduction reaction and makes good heat losses and heat-exchange inefficiencies. Hot hydrogen leaving the furnace is cooled somewhat by heat exchange against the topmost fluidized bed in the reducer, where most endothermic heat of reduction is required, and hydrogen then flows directly into the bottom reduction bed.

Petroleum refiners will recognize the process conditions of the H-Iron circuit as practically identical to hydrogen-circulation conditions in catalytic reforming of naphtha. A guiding principle in development of the H-Iron Process has been the desire to use standard petroleum refinery construction and processing conditions. By limiting reduction temperature to 900 F, it is possible to provide endothermic heat of the iron-ore-reduction by heating hydrogen to temperatures practicably attainable in standard furnaces of types found in general use throughout the petroleum industry.

Behind the H-Iron Process are nearly 50 years of mechanical development by the synthetic ammonia industry, and more than 20 years of development by the petroleum industry, in equipment for handling hydrogen at pressures of 500 psig and higher and at temperatures in the neighborhood of 900 F. The petroleum engineer is well aware of the sharp increase in difficulties and costs when gases are handled at temperatures well above 1000 F.

History of Development

The H-Iron Process is in fact a natural outgrowth of a project for the petroleum industry undertaken in the

[2] C. W. Albright, J. H. Holden, H. P. Simons, and L. D. Schmidt, *Chemical Engineering*, June, 1949, p. 108. K. R. Barker, J. J. S. Sebastian, and Schmidt, *Industrial and Engineering Chemistry*, vol. 43, 1951, p. 1204. Albright, Holden, Simons, and Schmidt, *Industrial and Engineering Chemistry*, vol. 43, 1951, p. 1837

PETROLEUM TECHNIQUES For STEEL

early 1940's. At that time, in connection with a synthetic gasoline plant, it was necessary to install the first large-scale iron-ore-reduction facility which incorporated essential features of the H-Iron Process.

This facility produced about 20 tons per day of reduced iron powder (which was used as a catalyst for synthetic gasoline manufacture) by contacting iron-ore fines with hydrogen in a fluidized bed operating at about 750 F and about 250 psig. Reducer capacity was low, by comparison with present H-Iron designs; a reduction rate of less than one half ton per day per sq ft of reducer area was obtained. This discrepancy is due in part of course to the lower temperature, lower pressure, and presence of only a single reduction bed. But a large factor in the low reduction rate was poor gas-to-solid contact in an open 8-ft 6-in-diam reduction vessel. Operation of the vessel was extremely rough, with much bumping and heaving of the bed.

This plant also utilized 16-ft-diam synthesis reactors, in which iron powder was fluidized with hydrogen and carbon monoxide, and first operations of these quickly confirmed the difficulty of scaling up results obtained in pilot-plant fluidized-bed reactors to the commercial scale. Scale-up difficulties are particularly great when a heavy powder such as iron is involved, and when high-reactant conversions are sought.

By early 1952, it was believed that a solution had been found to the fluidization scale-up problem, based upon fluidization of iron ore in a 24-in. test vessel without conducting chemical reaction. During this test work, two parameters were used to judge the quality of a fluid bed: apparent fluidized-bed density (as determined by differential pressure readings across portions of the bed), and carry-over. Various arrangements of internals placed in the bed were studied in the general desire to secure both a low bed density and a low carry-over. (It may be of interest to record that extremely wide variations in both bed density and carry-over may be obtained, with a given iron ore and at a given fluidizing velocity, simply by varying the geometry of internal design.) It was reasoned that low bed density represents high gas hold-up within the bed, which plausibly may result from presence of gas in form of small bubbles rising at relatively low velocities. Low carry-over also is a reflection of small gas bubbles, smoothly percolating up through the bed, and breaking from the surface of the bed without violent geysering and bumping.

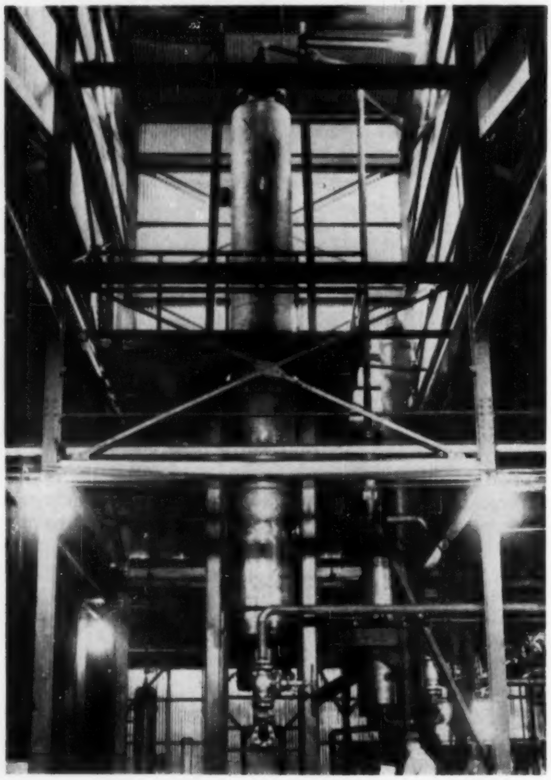


Fig. 4 First full-scale operation (1953), a semicommercial reducer at Hydrocarbon's Trenton, N. J., laboratories, shown prior to insulation. It is hoped that the application of petroleum-refining techniques to steelmaking will help hold down the costs of one of our basic commodities.

A Semicommercial Plant

In 1953, Hydrocarbon Research erected a semicommercial H-Iron plant at its Trenton, New Jersey, laboratories. Operation of this plant has confirmed our fluidization scale-up principles. Substantially identical reduction rates and conversions of hydrogen to water have been obtained in a 34.5-in-ID semicommercial reduction vessel as were obtained in a 6-in-ID experimental reducer. Evidence secured during this work gives full confidence to scale-up from the semicommercial plant to full commercial-scale reducers much larger in diameter. (Fig. 4 is a photograph of the reducer prior to insulation.)

Out of this work has come the firm belief in the desirability of using elevated pressures when fluidizing a powder as heavy as iron ore. Even an increase in pressure from 250 psig to 400 psig affords a distinct improvement in fluidization quality, although increase above 500 psig appears to offer limited advantage. Scale-up difficulties for fluidization of iron-ore fines at pressures only slightly above atmospheric appear formidable if a close approach to the thermodynamically allowed conversion of reducing gas is desired. Even at theoretical conversions, reducer capacity at atmospheric pressure and at temperatures around 1500 F is appreciably less than in the H-Iron Process.

Choice of elevated pressure and a reduction temperature around 900 F limits the H-Iron Process to relatively pure hydrogen as the reducing agent, since carbon monoxide would be converted to methane under H-Iron conditions.

The H-Iron Potential

The H-Iron Process, besides reducing costs, will free the steel industry from the necessity of locating plants where coke is available. With oil and natural gas serving as sources of the reducing hydrogen being widely distributed and readily transportable to even remote locations, the H-Iron Process greatly multiplies the number of locations where steelmaking is economical.

Utility Boiler Fired with Delayed Coke and Coal

An agreement between a utility and a refinery has provided a market for by-product fuel and all-electric operation for the refinery; electrical load, cooling water, and fuel for the utility

By S. C. Brown, Jr., Assoc. Mem. ASME, Efficiency Engineer, Virginia Electric and Power Company, Hornsbyville, Va.

The possibility of using delayed coke, a refinery by-product with a limited market because of high sulfur content and other undesirable characteristics, as a combination fuel with coal led to an agreement between the Virginia Electric and Power Company and the American Oil Company. Rapid growth in the Tidewater-Virginia area made a new plant desirable in the vicinity of the refinery, and delayed-coke fuel would be available from the refinery for approximately 50 per cent of the requirements for the 150-mw steam-generating unit. The agreement made in 1955 covered both American Oil's power-cooling-water requirements and Virginia Electric's utilization of their by-products. The utility would also secure the refinery load in their electrical system.

"Delayed coke" is the residual product which solidifies in coking drums when residual hydrocarbons are converted to more highly valued distillates. When first removed from the drum it has the appearance of run-of-the-mine coal, except that it is dull black. Since it is a relatively friable material, further handling reduces it to a product resembling slack coal, except for occasional hard lumps.

Research on pilot-plant samples was the basis for an equitable contract and permitted a steam generator to be designed to burn the delayed coke efficiently. Samples showed a low volatile content, a wide range of ash-fusion temperatures, high sulfur content, and some vanadium and sodium. All these would definitely alter the performance and dependability of the unit. The low volatile content of the delayed coke would affect the stability of ignition and completeness of combustion. The refinery will reduce the price of the delayed coke if these characteristics deviate from a specified value.

Penalties in price will also result if the volatile content is less than 9.0 per cent, sulfur is in excess of 5.5 per cent, moisture content in excess of 7.5 per cent after air drying, and Hardgrove grindability is less than 55. The moisture-content penalty is adjustable for adverse weather conditions. If any abnormal maintenance expenses are incurred on the steam generator as a result of vanadium and sodium attack, the oil company will pay a proportionate share.

Contributed by the Fuels Division and presented at the joint Solid Fuels Conference, Old Point Comfort, Va., October 9–10, 1958, of The American Society of Mechanical Engineers and the American Institute of Mining, Metallurgical, and Petroleum Engineers. ASME Paper No. 58—Fu-1.

Table 1 illustrates the analysis of the fuel burned in the unit. Included are the analysis of typical West Virginia bituminous coal, a range analysis of pilot-plant samples of coke on which the agreement is based, a range analysis of the coke burned during the first 11 months of operation, and a typical analysis of the coke burned during the same period. All of the items in the actual analysis of the delayed coke have followed the pilot-plant sample within acceptable limits, except the benzol solubles (residual oil). This characteristic has not been as low as anticipated and samples have had a higher than expected residual oil.

Steam-Generating Equipment

The steam-generating equipment was designed to counteract the undesirable chemical and physical properties of the delayed coke.

Boiler. The boiler is a Combustion Engineering controlled-circulation unit of the radiant-reheat type, with a divided furnace rated at 1,200,000 lb per hour. The pulverized-fuel mixture is fired in conventional tilting tangential burners. Several features are incorporated to counteract undesirable characteristics of delayed coke:

1 Approximately 10 per cent lower heat release than normally employed for coal. The larger furnace volume improves combustion and reduces carbon loss by providing longer retention of the low-volatile fuel in the furnace proper, and should also minimize vanadium-sodium attack to the superheater and reheater by limiting the entering gas temperature to maintain metal temperature below 1150 F.

2 The vulnerability of the superheater to vanadium-sodium attack is further minimized by employing water-cooled spacers and hangers in those sections and by not using nickel and molybdenum-containing alloys.

3 The induced-draft-fan ducts, air-preheater rotor, intermediate and cold-end elements and housing, the mechanical-dust-collector housing and hopper were constructed of Corten in order to minimize sodium, sulfur, and vanadium attack in the induced-draft system. To further protect the regenerative air preheater, an oversize steam air heater was installed to maintain minimum mean cold-end metal temperatures of preheater at 250 F.

4 Excessive slagging and fouling of the superheater and reheater surfaces from the wide-range ash-fusion temperatures were eliminated by increasing the spacing of the elements throughout the entire superheater—16-in. centers were used in the high-temperature-section elements, open spacing of those in the primary sections was increased from 1 to 2 in., and intermediate-section spacing was increased proportionately.

5 Slightly oversized bowl-mill pulverizers were installed to permit handling of coke containing a small amount of residual oil and also to provide a higher degree of fineness, if found necessary for complete combustion of the delayed coke. The low volatile content of the coke requires burning in combination with coal. A dual feeder arrangement, Fig. 1, permits selective combination of coal and coke before each enters the pulverizer.

Table 1 Analysis of Delayed Coke and West Virginia Bituminous Coal[a]

	Coal, typical sample	Delayed coke, pilot-plant samples, range	Delayed coke, actual samples, range	Delayed coke, typical sample
Moisture	4.00	2–10	3–12	6.65
Volatile matter	31.00	9–15	10–20	12.09
Fixed carbon	57.00	88–73	88–71	86.67
Ash	8.00	0.3–2.0	0.2–3	0.71
Btu per lb, as rec'd	13500	...	...	14470
Btu per lb, dry	14060	14000–16000	14100–15600	15507
Sulfur	1.10	1.0–5.5	2.9–5.4	4.27
Hardgrove grindability	55	50–95	74–100 +	94.6
Ash-softening temp, deg F	2650	2200–2700	...	2770
Vanadium	...	0.002–0.2	0.048–0.053	...
Sodium	...	...	Nil	Nil
Benzol solubles	...	1.0–8.0	3.8–9.0	6.5

[a] Proximate analysis, per cent weight.

Handling of Delayed Coke

The delayed coke is removed from the refinery coking drums hydraulically. The process consists of mechanical boring followed by impact cutting of the material with a high-velocity rotary water jet operating at 2400 psi. The coke is cut in layers and drops to a sump below the drums, where it is removed by a drag scraper to the refinery's dewatering pile. After dewatering for 48 hr, the coke is transported to the Virginia Electric storage area by a 28-ton-carrying-capacity earth mover. This equipment can deliver approximately 300 tons per hr to the coke-storage area which is made up of two individual areas, both common to the reclaim hopper. The refinery delivers coke to one pile while the utility reclaims from the other, allowing a maximum drying time of 3 to 4 weeks before it is transferred to the bunker.

Operating Experience

Delayed-Coke-Handling Problems. When the delayed coke was first handled it presented a problem, because it had different characteristics from coal, particularly in the consistency of the coke and the residual oil. This material is granular and packed so severely that the bulldozers reclaiming the coke would tend to lose their load before reaching the reclaim hopper. The coke had alternately hard and soft areas and as the bulldozer worked across the pile, the surface of the pile would get a sine-wave effect. Of the two bulldozers used on the coke pile, the one equipped with a hydraulic blade was superior to the cable blade on this type of operation. This condition made it very difficult for the equipment operators to push the coke with any speed over a distance of about 100 ft. As experience was gained in operating the level of the bulldozer blade, the reclaim capacity rose from 98 to about 400 tons per hr on a 100-ft push.

During the warmer months of the year, coke is reclaimed at the same rate that coal can be emptied from the coal cars, which is about 350 to 400 tons per hr. This is based on a 100-ft push on the coke. In the winter months, when rain, snow, and freezing temperatures hamper operations, the reclaim rate of the coke drops to a point where it is not economical to attempt to burn it.

Owing to its porosity, the moisture in the coke during these months varies between 9 and 12 per cent by weight. To move this coke in the winter, the feed to the conveyer belt had to be reduced from a 400-ton-per-hr rate to less than 100 tons per hr, to prevent the crusher from plugging up. When coke with a moisture above 10 per cent is supplied to the coke bunkers, it is extremely difficult to move the coke from the bunkers through the scales.

Combination of Delayed Coke and Coal. Delayed coke and coal have been fired in combination for the past 11 months and 11 tests have been conducted to determine the performance of the unit on various combinations of delayed coke and coal.

Fig. 2 illustrates the characteristics of delayed coke combined with coal. These data are based on monthly prorated analyses.

The 50:50 ratio of coal to delayed coke was selected as the most advantageous mixture to maintain based on the refinery's average monthly production of delayed coke and the utility's monthly fuel requirements. The refinery averages approximately 15,000 tons of delayed coke each month and the utility's fuel requirements are about 38,000 tons of coal plus coke. A 50:50 ratio would amount to 19,000 tons of coal and 19,000 tons of delayed coke. As this is 4000 tons in excess of the refinery's monthly production, it is not possible for 12 months.

Experience during the first winter proved that during periods of rain, snow, and freezing weather it is not economical to handle the delayed coke from the storage area to the bunker. With this experience it would be to Virginia Electric's advantage to burn the delayed coke at a 50:50 ratio with coal for periods amounting to the equivalent of nine warmer months of the year and stock pile the delayed coke for the remaining 90 days. This way a 50:50 ratio could be maintained and considerable expense in handling could be saved. The 90 days involved may not necessarily be consecutive, but will be determined by weather conditions and the results of daily moisture determinations.

Vibrators have been installed throughout the system, but they only succeed in packing the coke when the moisture is above 10 per cent but do an excellent job under 9 per cent.

Comparison of Performance. The results of three tests run at normal maximum load on Unit No. 1, Yorktown Power Station, are shown in Figs. 3 and 4. The boiler efficiency was calculated as the sum of losses subtracted from 100 per cent.

This unit is equipped with steam air heaters to heat the air going to the regenerative air preheaters to protect them from corrosion and plugging caused by a too low cold-end temperature. The average cold-end temperature is maintained at 185 F when burning coal alone, and at 250 F when burning coal and coke. This high temperature is necessary to prevent condensation of the sulfurous by-products of the combustion of the delayed coke. The effect of these steam air heaters has not been compensated for in calculating the boiler efficiency. Raising the air-preheater average-cold-end temperature lowered the dry-gas loss because the air temperature entering the air preheaters was raised proportionately higher than the temperature of the flue gas leaving.

The steam for the steam air heaters is normally taken from the third-point-extraction line to the deaerator. By increasing this steam flow, the cycle heat rate is improved because the heat rejected to the condenser is lowered by the amount of steam used in the steam air heaters. The low hydrogen content of delayed coke results in a decrease in moisture loss as the percentage of coke burned is increased, because of the relatively greater moisture loss from the combustion of the hydrogen compared with the moisture content of the fuel.

Fig. 3 illustrates that the carbon loss increases as the percentage of coke burned is increased. The per cent combustible in the refuse increases at a much higher rate

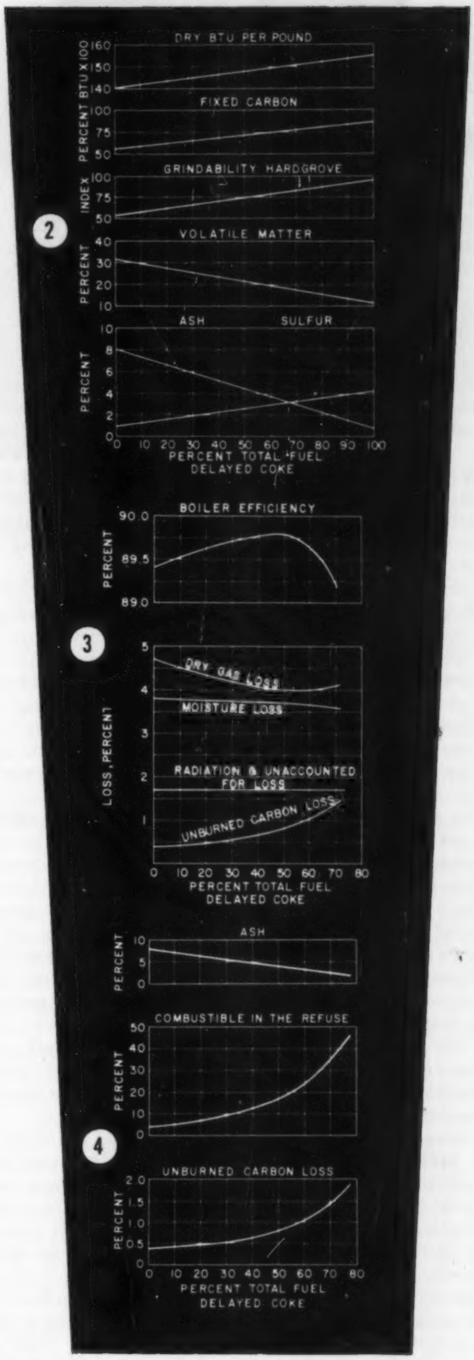


Fig. 2 Comparison of the characteristics of delayed coke combined with West Virginia bituminous coal

Fig. 3 Comparison of boiler efficiency, dry-gas loss, radiation and unaccounted-for loss, and unburned-carbon loss, versus per cent of total-fuel delayed coke

Fig. 4 Comparison of ash, combustible in the refuse, and unburned-carbon loss, versus per cent of total-fuel delayed coke

than the carbon loss, but this is partially compensated for by the reduction in the ash content of the combination fuel being burned.

The radiation loss and unaccounted-for losses are considered to remain constant regardless of the ratio.

As shown on the curve, the boiler efficiency improves as the coke ratio increases because of the previously mentioned steam air heaters. As the coke ratio is further increased, the boiler efficiency decreases below the value for coal alone; this decrease is caused by the high carbon loss. If the steam air heaters were not used, the boiler efficiency would vary almost inversely with the carbon loss.

Carbon Loss. The combustible in the refuse may be further reduced when the specified reheat steam temperature can be obtained with minimum upward burner tilt. At the present time, the hot and cold reheat temperatures run about 10 F below design. In order to maintain the hot reheat temperature as near 1000 F as possible, it is necessary to operate the burner tilts between 20 and 30 deg above horizontal, resulting in a shorter burning time for the fuel mixture.

The residual oil is another contributing factor to the high combustible in the refuse when the delayed coke and coal are burned in combination. Tests show that the residual oil in the coke runs between 3 and 8 per cent by dry weight. When the percentage of residual oil in the delayed coke is high, the coal and coke particles agglomerate, regardless of the fineness set on the mills. At present, there is not enough residual oil to affect pulverizer capacity, but Virginia Electric reserves the right to reject the delayed coke if this happens.

The theory of the effect of residual oil is derived from the results of tests conducted to determine the combustible in the fly ash leaving the air heater. Samples were taken across the duct at a metered gas flow for each point. An analysis of the composite of the samples showed that approximately 43 per cent of the sample was retained on a 100-mesh screen. The combustible in this portion of the mixture was about 70 per cent. The per cent combustible of the entire sample was 47 per cent. This test was conducted when the fuel ratio was 50:50 and the pulverizers were scheduled for overhaul. The fineness of the pulverized fuel was up to standard, but the pulverizers were limited in capacity. This test was run at maximum load on the unit.

It was felt that this inconclusive test did indicate that oily particles of delayed coke tended to combine with the particles of coal in the fuel stream and create a larger particle with less surface by weight to come in contact with the air. As a result, the combined particle does not have sufficient time to burn completely and is carried over as combustible in the ash.

Among the first tests on the pulverizers conducted to determine fuel-fineness setting the same condition existed. The samples on all screens had a tendency to "ball up" when placed in the Ro-tap automatic shaking machine. This occurred with the horizontal oscillations and not particularly with the vertical oscillations. The operating temperature of the pulverizers was raised from 160 F to 180 F to remedy this condition. The situation improved but was not completely eliminated. Fineness samples could not be run to produce acceptable results until the samples were placed in a drying oven for a period of one hour at 105 C. This procedure was satisfactory until the percentage of residual oil in the coke increased and fineness sampling again produced erratic results.

Presently to set the pulverizers for combination fuels, the fineness tests are run when the pulverizers are operating on all coal. The setting is made to produce 75 per cent through a 200-mesh screen as this will result in approximately 80 per cent through a 200-mesh screen when combining 50 per cent coke and 50 per cent coal. The higher fineness for coke and coal combination is due to the higher Hardgrove grindability index of the coke. Higher fineness also tends to reduce the unburned carbon loss.

Inspection of Steam Generator

Boiler. An extensive inspection of the steam generator and related equipment after six months of operation on coal and delayed-coke combination fuel determined the probable maintenance that would be caused by burning delayed coke. It was found that the reheater platens, the superheater platens, screen tubes, furnace tubes, casing and ducts, as well as tube spacers were in good condition and showed no signs of wastage that would be a result of vanadium, sodium, or sulfur attack.

Pulverizers. Periodic inspections were made on the pulverizer equipment and, after handling approximately 135,000 tons of coal and coke on each of the four pulverizers, *A* and *D* pulverizers were overhauled. New rolls and bull rings, about two thirds of the upper millside liners, the millside deflectors, the exhauster fan blades, and several new casing periphery-side liners were installed. In general, these mills did not indicate any more, if not less, wear than normal for comparable pulverizers when handling the same grade coal alone. Pulverizers *B* and *C* are in about the same condition.

Air Heaters, Dust Collectors, and Induced-Draft-Fan Ducts. These units have been inspected about four times since the start of operation of the unit, and there has not been any indication of unusual wear or corrosion that could be attributed to the delayed coke.

Conclusions

Both companies are well satisfied with the sales agreement. It provided the American Oil Company with their first all-electric refinery and has given Virginia Electric and Power Company the opportunity to utilize a by-product fuel at a lower price than the cost of delivered coal, with substantial savings to both companies.

The burning characteristics of the delayed coke have been found to be better than anticipated. Up to the present time there has not been any indication of vanadium, sodium, or sulfur attack. The design features of the steam-generating unit to counteract the undesirable characteristics of the delayed coke have proved completely satisfactory.

The handling of the delayed coke during the winter still presents a problem, but with the present refinery capacity a 50:50 fuel ratio can be maintained 9 months out of the year.

There is still considerable experience and information to be gained on burning coal and coke in combination. This combination-fuel firing is being studied to produce results that will be economical and efficient to operate.

Acknowledgment. The author gratefully acknowledges the assistance and suggestions of all associates in making this paper possible.

THE HEAT EXCHANGER—

AN ECONOMIC STUDY

By G. T. Atkins[1] and N. O. Felps[2]

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The goal: An economic optimum. In petroleum, engineers of Design and Maintenance pool their information on heat exchangers. Here's how they balance initial cost against future maintenance.

In a heat-exchange installation, the provision of excess surface over and above that required for the theoretically clean condition is properly the subject of an economic balance between initial cost and later maintenance expense. Information should be at hand so that the surface area can be calculated to fall in the vicinity of the economic optimum.

In this report, maintenance experience with a large group of refinery heat exchangers during a two-year period has been tabulated for the purpose of forecasting maintenance expense. A hypothetical example has been worked out to illustrate a method of using this information.

The participation of Maintenance as an engineering function, along with Design, is imperative for achieving an economical and satisfactory heat-exchanger installation.

Data and Interpretation

During the two-year period, 1955–1956, 1500 shell-and-tube exchangers in service at a large refinery were studied. Some were relatively new and had not required maintenance. Others had seen nearly their full life. Most were installed 10 to 15 years ago. They covered a great variety of size, design, and type, representing products of 25 manufacturers.

For purposes of this study, the following were excluded: Tank-heating coils; box coolers; engine-jacket water and lube-oil coolers; air-conditioning items. The greater number considered were in the size range of 1000 to 3000 sq ft of surface, with removable-bundle, floating-head construction. All were in accordance with the recognized codes for good materials, design, and construction.

While the experience on any single exchanger would be relatively easy to present, it would still be only an isolated and perhaps unique instance, without any proved relation to the next exchanger. It is desirable to consider a wide assortment of exchangers, viewing the results for whole classes and types. Whatever the shortcomings of this sort of rough averaging, it does at least make a start, and a big one, toward supplying the needed numerical data.

The raw data need interpretation. It will be apparent that an adjustment is called for on the basis of the statistics, namely, the number of exchangers in service. As refining and petrochemical processes have improved in technology and grown in capacity and complexity, there has been a substantial increase in the number of heat exchangers in service. Adjustment is made by using divisors, increasing from about 500 to 600 for the oldest group up to the 1500 in service during the two-year period of June 30, 1955, to June 30, 1957.

Life of an Exchanger

During the two-year period, a total of 45 shells was retired. An average life of 25 years is found when one uses a divisor of 500 to 600. That is: In a refinery which is maintained at constant capacity, 20 to 25 new exchangers installed each year and lasting an average of 25 years would correspond to a total of 500 to 600 in service.

Experience shows that 25 years is indeed a typical life of a refinery-type exchanger. But, obviously, if corrosion is severe or the materials not entirely suitable for withstanding corrosion, then that exchanger would be

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Severe fouling after six months of vaporizing naphtha

Table 1 Analysis of Maintenance Experience

Degree of maintenance	Average	Below average	Above average
Type of service	Average	Clean	Dirty
Average life of tubes, yr	7	20	4
Average run length, yr	1.05	1.75	0.75
Inspect exchanger, times/yr	0.95	0.57	1.33
Make minor repairs, times/yr	0.24	0.20	0.28
Clean tubes in place, times/yr	0.20	0.20	0.20
Remove and clean bundle, times/yr	0.35	0.10	0.60
Retube bundle, times/yr	0.09	0.03	0.15
Install new bundle, times/yr	0.03	0.01	0.05
Retire exchanger, times/yr	0.04	0.03	0.05

expected to have a correspondingly shorter life. Also, obsolescence is a factor, for when exchangers are retired they are not, in our experience, replaced in kind. Better materials, designs, and processes are available and are used in the modern units which take the place of the old ones.

Tubes and Bundles

In 39 cases whole bundles were replaced with new ones, whereas 172 were retubed using the original tube sheets, support plates, and baffles. Experience has shown that bundles with nonferrous tube sheets can be retubed about three times (although unskillful rolling can ruin them sooner), while steel tube sheets can be retubed about four times. Beyond this, distortion of the sheets and general corrosion of the parts make it necessary to replace the entire bundle. In a few instances, redesign using another tube diameter or layout is an occasion for getting a new bundle.

When tubes do not last as long as expected and corrosion is found to be the cause of the reduced service life, then the procedure usually followed is to make an economic analysis to determine if the use of more corrosion-resistant materials can be justified. Thus many unfavorable early difficulties eventually prove to be nonrecurrent. For completely new bundles, a divisor of 600 to 700 is judged appropriate, giving an anticipated replacement of 0.03 times per year per exchanger. For retubing, a divisor of 900 to 1000 gives an anticipated frequency of 0.09 times per year. Altogether the average life of exchanger tubes is about 7 years.

As the life of tubes varies greatly from one service to another, a distinction should be made which is represented by the schedule of Table 1. In clean services the average life is 20 years, whereas in dirty services the average life is only 4 years. Of course, both longer and shorter lives could be cited. But the figures of Table 1 are such that clean and dirty services taken in equal numbers yield the same average as for the refinery. Descriptively, a clean service might be a light hydrocarbon or clean oil condenser or cooler; whereas a dirty service might be crude oil, distillates or residuum of corrosive, or fouling tendencies.

Cleanings and Inspections

During the stated 2-year period, 733 bundles were removed from their shells for cleaning both the inside and outside of the tubes. Using a divisor of 1000 to 1100, the frequency of doing this work is 0.35 times per year. In addition, another 2050 exchangers were opened for inspection and minor repairs where needed; but only about 500 of these were fouled. These 500 were cleaned in place. Using this time a divisor of 1200 or 1300, the frequency for this type of cleaning is 0.2 times per year.

During the two-year period there was a total of 3039 inspections, for which a divisor of 1400 to 1500 should be used, thus resulting in an average frequency of 1.05 inspections per exchanger per year. In the cleanest services, experience leads to the selection of a two or three-year period between inspections; in the very severe services, turnarounds for cleaning and repairs occur at intervals of four to six months; but the largest number of exchangers are scheduled for inspection at about one-year intervals, with much of the work being planned for the first six months of the year when crude runs to the refinery are usually at a minimum.

Economics of Design

After other prime considerations have been satisfied, the relative cost factors—as expressed in the concept of the economic balance—then control the design and sizing of process heat exchangers. Cleaning and repairs are expensive, but on the other hand the first cost of the installation can become excessive from a too-conservative selection of the excess heat-transfer surface or of the materials specified. The goal in mind is the minimum over-all cost when considering the opposing factors weighted one against the other.

To what extent should excess surface be called for in order to reduce the frequency of cleaning? Table 2 considers this question for the case of an exchanger in a typical service, with about the normal maintenance as represented by the statistics of the preceding section. It is found that the provision of only 20 per cent excess surface is in the direction of courting future high maintenance costs, whereas 60 per cent excess surface requires too large an initial investment. About 40 per cent excess surface is indicated as an economic optimum.

Translated into heat-exchanger rating terminology, it can be stated that in this example the fouling factor which should be used for the initial design should be about 40 per cent of the sum of the film resistances for the fluids on the tube side and on the shell side. With the requirement of this much excess surface (or performance) the lowest over-all costs are then to be anticipated Fig. 1 presents this economic optimum graphically.

In the example just considered, the provision of 40 per cent excess surface was considered optimum, but other examples might be presented to show circumstances where as little as 15 to 25 per cent excess surface, or as much as 60 to 100 per cent, would be a more logical provision. Suppose for example that incremental surface is relatively costly, and that fully proved chemical agents can be used continuously or at intervals for maintaining or restoring the performance; then the minimum excess surface should be provided. On the other hand, there are times when ample excess surface or perhaps an additional shell or two, with valves, will protect a major process unit against forced shutdown for exchanger maintenance. In these circumstances, if the excess surface comes relatively cheap, or conserves an increment of heat, then the economics may easily favor a full 100 per cent of excess surface.

Would the excess surface itself be insurance against future high maintenance expense? It might, if corrosion and fouling were moderate. But if the tubes corroded and failed, or if cleaning methods were inadequate to restore the service coefficient of heat transfer, then the excess surface would not have insured the desired performance. First, the tubes must be of the right material to resist corrosion; and then tube diameter, pitch and layout must be such as to permit cleaning. These features add to initial cost, but facilitate maintenance and thus reduce future costs. While this might seem theoretically to require additional economic balances, yet in practice it is usual to select some proved standards.

Materials and Construction

The usual choice of tube materials—those used in the 1500 exchangers reported here—are: (*a*) carbon steel, (*b*) ferrous alloys, and (*c*) nonferrous (copper) alloys. There are marginal cases in which the suitability of carbon steel is in doubt. As an example, an extended study on a plant scale is being made of the use of carbon-steel tube bundles in coolers and condensers using recirculated cooling-tower water; and here the problem is to establish and maintain at all times the correct concentration of chemicals and inhibitors in the water.

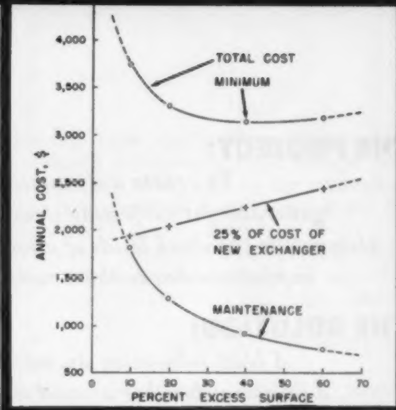


Fig. 1 Hypothetical case from Table 2, with an economic optimum at 49 per cent excess surface

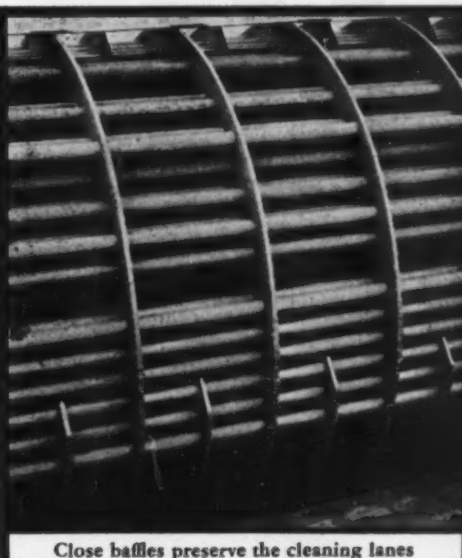
During the period from about 1925 to 1940 tubes on triangular pitch were used much more often than at present. Since then, many of those bundles have been replaced, the new ones being generally altered to a square pitch with cleaning lanes in two directions. Triangular pitch is still used if the service is considered very clean, or at least if the fouling on the outside of the tubes proceeds at so slow a rate that corrosion will terminate the useful life before fouling does.

Cleanability is improved if the bundles are sturdy; that is, with tube diameter, support-plate thickness, and spacing all adequate for the weight of the bundle; and also, if care is taken during handling so as not to bend the baffles or crush and squeeze the tubes together with resulting blockage of access to the interior of the bundle. If in-place cleaning with chemical agents or solvents is known to be effective in restoring the performance, then there is an opportunity to realize various economies in the initial cost; but if the bundles foul badly and need mechanical cleaning, then a more rugged exchanger should be specified and a limitation put on size even at the penalty of higher initial cost.

Table 2 Selection of Installed Surface

Surface area,[a] sq ft	1100	1200	1400	1600
Assumed costs ($)				
Clean tubes in place	400	410	430	450
Remove and clean bundle	700	725	775	825
Retube bundle	3300	3500	3900	4300
Install new bundle	5500	5800	6400	7000
Exchanger new	7700	8100	8900	9700
Times per year				
Clean tubes in place	0.5	0.35	0.2	0.12
Remove and clean bundle	0.8	0.55	0.35	0.25
Retube bundle	0.20	0.135	0.09	0.07
Install new bundle	0.07	0.045	0.03	0.025
Replace exchanger	0.06	0.05	0.04	0.035
Annual cost ($)				
Clean tubes in place	200	142	86	54
Remove and clean bundle	560	399	271	206
Retube bundle	660	473	351	301
Install new bundle	385	261	192	175
Replace exchanger	—	—	—	—
Annual maintenance	1805	1275	900	736
Process credits/debits[b]	...	...	...	...
25 per cent of investment	1925	2025	2225	2425
Total, for 25 per cent payout	3730	3300	3125[c]	3161

NOTE: [a] Based on 1000 sq ft theoretical clean surface.
[b] Process credits assumed equal throughout.
[c] Economic optimum selection is 1400 sq ft.



Close baffles preserve the cleaning lanes

THE PROJECT:

To create a dynamic-load generator for subjecting structural elements to the shock loads of a nuclear explosion—but without radiation

THE SOLUTION:

A blast tube using an explosive, a pressure chamber around it, both with openings to control pressure rise and peak pressure, and valves to control decay time. The Blast Simulator is now in operation.

By W. W. Boynton, Mem. ASME

Director, Boynton Associates,
La Canada, Calif.

ATOMIC BLAST SIMULATOR

THE Naval Civil Engineering Laboratory at Port Hueneme, Calif., called for a test apparatus to reproduce on structural elements loads similar to those of a nuclear explosion but without radiation effect.

The Atomic Blast Simulator (Fig. 1) was developed, installed, proof tested, and put into operation. Its purpose is to advance the study of the dynamic loading of structures.

Formerly, dynamic load testing was accomplished via (*a*) the shock tube, (*b*) point loading, (*c*) hydraulic loading, and (*d*) field tests. The first three have some merit but do not duplicate the loading characteristics created by a nuclear explosion. Peak pressures and rise times can be readily reproduced in the shock tube. Their decay times, however, are extremely short and the ratio of model to diameter of the shock tube is very great, thus requiring an extremely large shock tube. Point loading on a beam or structure does not reproduce the uniform loading created by a blast. Hydraulic loading does not have fast enough response and puts a preload on the structure. Field tests have proved extremely unreliable.

Contributed by the Machine Design Division and presented at the Annual Meeting, New York, N. Y., Nov. 30–Dec. 5, 1958, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Paper No. 58—A-215.

The Basic Parameters

For the new Simulator, the following parameters had to be met:

1 That the time-of-rise to the peak-pressure condition be from one millisec to 20 millisec.

2 The peak overpressure be variable, but not necessarily continuously, from 45 to 185 psi.

3 The reduction of pressure approach the curve defined by the equation

$$P = P_o(1 - T/T_o)e^{-T/T_o}$$

where

P = the pressure at any given time ($T < T_0$)

P_o = the peak overpressure (45 to 185 psi)

T = the time after peak pressure at any given time during the pressure decay (sec)

T_o = the duration of the positive phase of the blast in seconds (which may be varied from 0.4 to 7.0 sec).

Review of earlier experimentation indicated that the logical approach lay in loading the structural element by gases in a confined space.

Analysis showed that stored high-pressure gas at ambient temperature, with valves releasing this gas into a chamber, would not be feasible both as to storage and valve requirements. A fast response valve as large as the storage chamber would be required to get the gases in as rapidly as required. Therefore, ways and means were sought to generate high-pressure, high-temperature gases to produce the desired shock loads.

The first step was to try using a propellant which had a known controlled burning rate and to depend on this burning rate to determine the time-of-rise.

Black powder was chosen, and a $^1/_{10}$-cu-ft pressure chamber was made up for the first experimental work. Thirty-four tests were conducted and reproducible results were obtained.

Next, a one-cu-ft chamber was made up. In 28 tests it was found that reproducibility was not constant. Investigation revealed the cause—variability of the burning rate of black powder from batch to batch. Other propellants were found to have the same variability. Therefore some means of controlling time-of-rise other than burning rate had to be explored.

The "Double-Decay" System

It was reasoned that an inner chamber or firing tube could be placed in the pressure chamber. This firing tube would have a predetermined venting area in the form of multiple orifices. In it would be placed an explosive with an extremely high propagation rate. Energy released would be controlled by the number and size of the orifices venting the hot gases into the pressure chamber, thus determining time-of-rise and peak pressure. The decay portion of the shock wave would be controlled by venting the pressure chamber to atmosphere at a predetermined rate for a given test.

For the experimental apparatus (Fig. 2), PETN Primacord was chosen for the explosive because of its high

rate of propagation (22,000 fps, or approximately 1/4 in. per microsec). This Primacord was stretched along the center of the firing tube, and set off by an electric blasting cap.

On the main chamber, the specially developed quick-opening valves were sequenced to open at discrete intervals to produce the desired pressure-decay curve.

Thirty-six tests were conducted in this experimental chamber. The instrumentation (Fig. 3) confirmed good reproducibility in time-of-rise, peak pressure, and decay.

This approach was believed to be an entirely new concept. In reality, two gas-venting systems, one within the other, were being used for control of a prescribed shock loading, a double venting system. By usage, the term "double-decay system" has been established.

Preliminary Design

The next phase of the project was the preliminary design of the Atomic Blast Simulator. The structural element to be tested was a beam with either simple or fixed-end connections. This beam, 6 in. wide, 8 to 12 in. deep, with a span from 9 to 15 ft, had to be free to deflect, deform, or fail. It would be subjected to uniform dynamic pressure loads along its top, these loads ranging in peak pressures from 90 psi gage to 195 psi gage, with times-of-rise from 0.75 millisec to 3.0 millisec, and decay times from 0.4 sec to 1.5 sec.

These requirements, coupled with the previous work (development of the double-decay system), made it evident that the simulator would consist of a long cylindrical pressure chamber containing a long firing tube, a narrow long test cell open to the pressure chamber on one side and atmosphere on the other, means of supporting and restraining the test specimen in this cell, means of preventing gases blowing by the specimen, and means of venting to get the desired decay curve.

Also, a decision had to be made as to whether the specimen supports would be in a fixed position and the simulator movable, or vice versa. It was decided to make the simulator fixed.

The layout chosen consists of a 2 ft by 18 ft pressure chamber having 3/4-in. steel walls and removable flanged ends. It contains a transverse baffle system and, along its center, the firing tube. Along the pressure-chamber top are 22 pads having 1-in-diam holes for the 22 quick-opening sequenced exhaust valves.

The test cell, an extension of the pressure chamber, is made up of a three-piece weld mount: a slotted plate 16 ft long, 11 in. wide, and 2 1/2 in. thick, and two side plates 16 ft long, 30 in. deep, and 1 1/2 in. thick, forming an inverted "U," the slotted plate replacing a narrow longitudinal section of the chamber wall.

This assembly, the chamber and cell, is reinforced by 12 "horse collars," two of which extend to become the four legs of the Simulator.

The end closures of the test cell are two carts on a track running through the Simulator. These carts are also used for installing and supporting the test specimen.

With the test cell acting as a nozzle, at maximum pressure loading (185 psi) a downward thrust of 215,000 lb can be developed. To take care of this loading, the steel portion of the Simulator was securely tied through its legs to a heavy reinforced concrete mat, making this slab an integral part of the Simulator.

Also included in the preliminary design was a schematic wiring diagram of the instrumentation including the pressure-measurement circuits of the oscillograph, the blasting-cap circuit, and the circuitry required for sequencing the 22 quick-opening exhaust valves along with a plan and sections of one of these valves.

During the development of the Simulator, T-1 steel became a commercial item. It is a low-alloy, high-strength weldable steel which maintains its strength after welding, requires no heat treatment, is extremely tough and highly resistant to notch effect. Its use in the pressure chamber portion of the Simulator was obvious.

Also during the development, the requirement was added that the Simulator be designed to test structural elements other than beams; namely, frames. These frames were to receive the shock load from the side, not the top.

To modify the design to include frame testing required practical solutions to three basic problems:

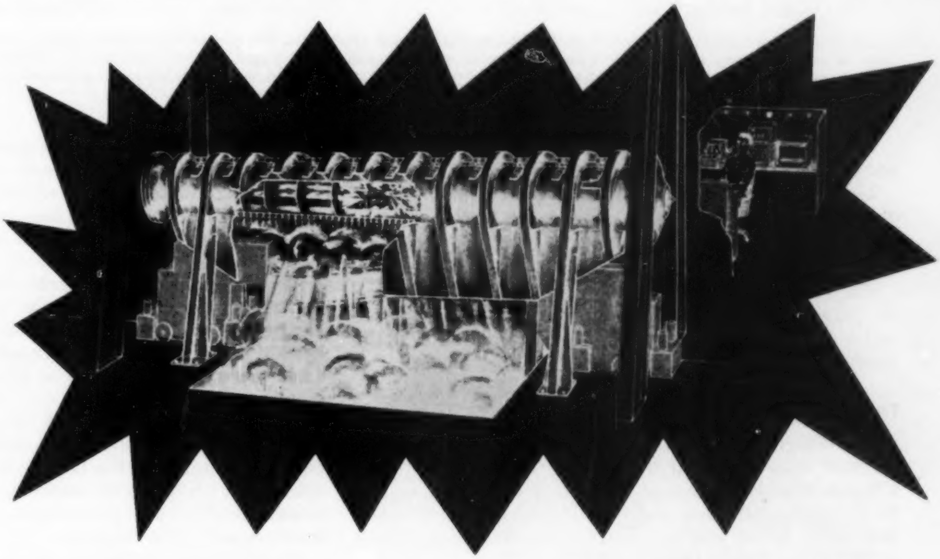


Fig. 1 The Simulator, a main pressure chamber, 2-ft diam by 18 ft long, with a long firing tube 6-in. OD, centered on the chamber's longitudinal axis. Explosion gases, venting into the main chamber, create the time-of-rise and peak pressure required. Decay time of the shock wave is simulated by exhaust values on the main chamber.

ATOMIC BLAST SIMULATOR

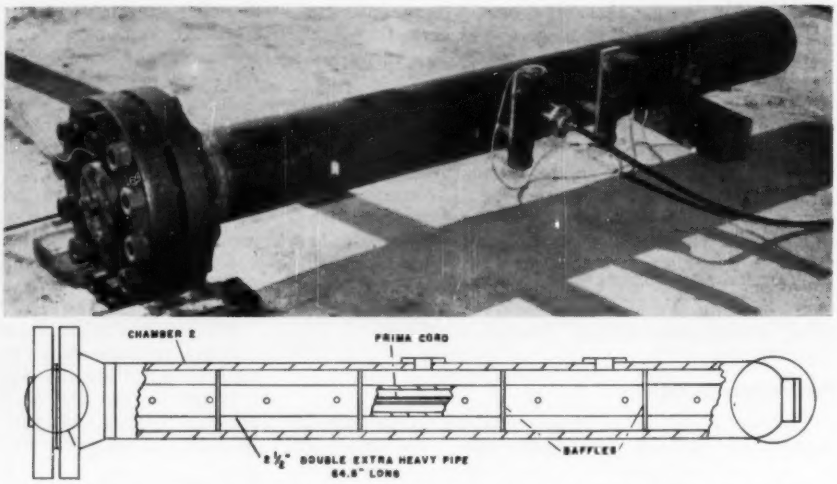


Fig. 2 The experimental apparatus, the pressure chamber made of 6-in-diam pipe, 5 ft long. The firing tube, extending the full length of the chamber, is of thick-walled tubing, $2^1/_2$-in-diam, and has 300 equally spaced orifices. Quick-opening mousetrap valves were developed for the main chamber for pressure-decay control.

1 Positioning the frame on its side in the Simulator and removal of the frame following testing.

2 Supporting the frame to obtain the desired degree of rigidity.

3 Sealing the leg of the frame during testing to prevent bypass of the combustion gases.

The most practical way of positioning and removing the frame from the Simulator was to work from its side and bottom. Therefore a pit was incorporated into the design.

The Simulator Takes Shape

The design (Fig. 4) now called for a 20-ton, T-1 steel pressure vessel, 50 cu ft in volume, tied to the top of a 175-ton heavily reinforced concrete pier having in it a pit 10 ft long, 9 ft wide, and $12^1/_2$ ft deep to accommodate the frame being tested. Three reinforced steel panels cover the pit during beam testing.

The carts now have three functions; they not only act as test cell closures and beam supports, but they are also used as part of the rigid supports for frame testing.

The other frame supports are: A strongback representing the ground connections of the frame which is bolted rigidly to one pit wall and a cart; and a 50-ton jack provided to take the transmitted downward thrust of the strongback. Means of sealing the frame are also detailed.

The main source of energy, explosive material (Primacord), is supported along the center of the firing tube by $^3/_4$-in-diam copper tubing. The firing tube, 18 ft long, 6-in. diam, having 3000 uniformly spaced orifices, extends along the center of the main chamber. The tube was designed with $^3/_4$-in. walls to withstand the combustion pressure and temperature generated by the Primacord. The first firing tube was drilled with $^1/_4$-in-diam orifices to give an estimated pressure-rise time of 1.5 millisec for the maximum pressure required. The design specifications included a drilling jig for drilling the 3000 orifices and two other undrilled firing tubes to be drilled to orifice diameters determined in testing.

The peak pressure is controlled by the size of the charge. The rise time for a particular charge is controlled by the size and number of orifices in the firing tube. The decay of pressure is controlled partially by the cooling of the gases due to heat loss to the chamber walls and further by the release of gas through quick-opening valves.

It was determined during the experimental work that the materials deposited on the pressure chamber walls during the test must be removed from the chamber following each test to obtain reproducible pressure decays. This was verified during the proof testing, the higher pressures showing a greater variability than the low-pressure tests. The method (Fig. 5) for cleaning the chamber and test cell consists of traversing the chamber two to six times with a lance having a nozzle head of 36 nozzles which direct the steam toward the chamber and test-cell walls. The higher the pressure of the test, the more passes have to be made.

Shortly before submittal of the final design, a request was made for a layout and cost estimate on additions deepening the test cell for either top or side loading of arches. It was also requested that the design of the test cell be modified to accommodate the connections for this addition. These additions are now being made and have grown from side wall extensions to a totally enclosed test cell with a 3 ft × 5 ft window. The totally enclosed cell will be used for testing sections of underground structures and soils.

Hydrostatic Test

Upon completion of the machining, the Simulator was subjected to a hydrostatic test of 380 psi (Fig. 6). This was the first time the calibration beam was used—a rigid, removable steel structure that fits the test-cell aperture and is mounted on four wheels. The beam was designed not to deflect under highest anticipated loads. It is used for hydrostatic, proof, and calibration testing.

The test curves recorded during the hydrostatic pressure tests deviate only slightly from the calculated values and are well within the experimental error of the

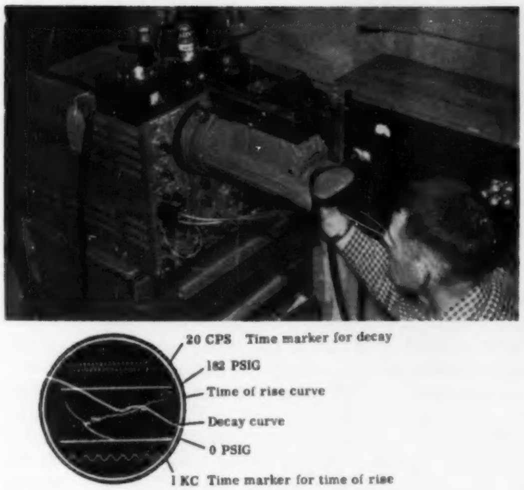


Fig. 3 The instrumentation consisted of a piezoelectric gage, its amplifiers, and a dual-beam oscilloscope with a camera to record this oscilloscope display. Typical test records are shown.

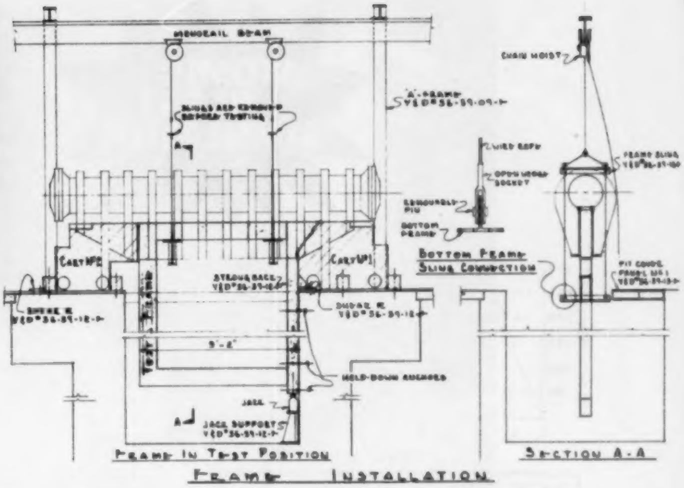


Fig. 4 The developed design. Specimen supports are movable, the Simulator fixed. The long, narrow test cell is open to the pressure chamber on the top, to the atmosphere on the bottom.

instrumentation used to take these measurements. The outward deflection of the test-cell side walls with pressure is depicted.

The first test was fired on April 12, 1958. The simulator was dedicated April 22, and 37 tests were conducted, being completed in late June.

No major problems were encountered during the erection (Fig. 7).

This proof testing brought up more problems than were anticipated, although when one changes scale one expects new problems to arise, especially when it is changed by a factor of 50.

For the first 10 tests, 50-grain-per-ft reinforced Primacord was used. The covering of this Primacord consisted of cellulose, wax, and asphalt, combustibles which made up 60 per cent of the total Primacord weight. This meant a very unfavorable oxygen balance, producing excessive soot, long time-of-rise, and low pressures. These curves fell far short of the requirements.

It was decided to try an explosive having a much more favorable oxygen balance, which turned out to be 100-grain-per-ft plastic Primacord whose covering consisted of 20 grains of cotton and 37 grains of polyethylene, thus cutting the combustibles down to 25 per cent of the total weight of the charge.

The next step was to introduce a propellant to produce longer decay times. Nitrocellulose film was added to the charge and the decay times were lengthened materially.

The polyethylene was then stripped off the Primacord. This was the greatest improvement yet. It lengthened the decay time, gave steeper rise times, a much cleaner exhaust, and less residue in the firing chamber. Upon analysis, this was the first test in which the theory and the test results coincided.

Analysis of Test Firings

The proper functioning of the Simulator depends on the rapid production of both additional gas and heat within the main pressure vessel according to the perfect

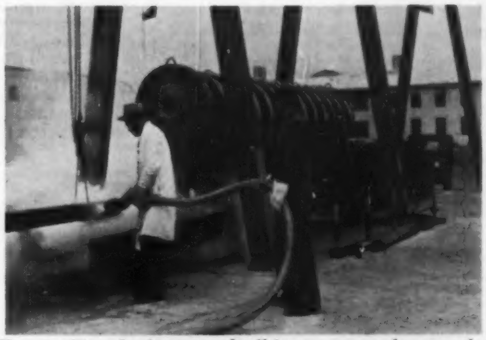


Fig. 5 To obtain reproducible pressure decays, the chamber and the test cell must be cleaned

For internal cleaning, a steam lance is used

ATOMIC BLAST SIMULATOR

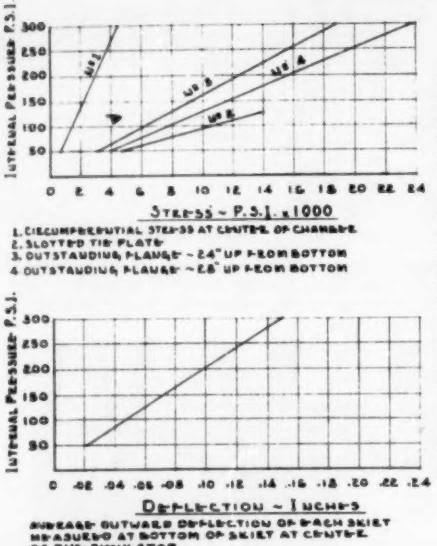


Fig. 6 Hydrostatic testing of the finished Simulator. Test curves deviate only slightly from the calculated values, and are well within the experimental error of the instrumentation. Outward deflection of the test-cell side walls is depicted.

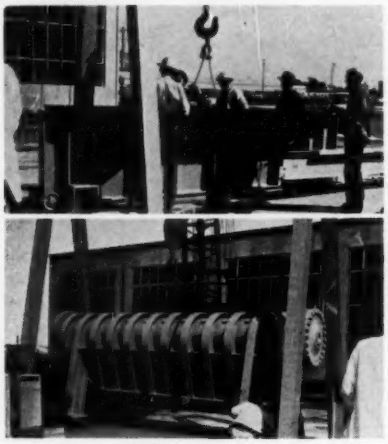


Fig. 7 Erection of the Atomic Blast Simulator. It was dedicated April 22 and, after 37 tests, was completed in late June, 1958.

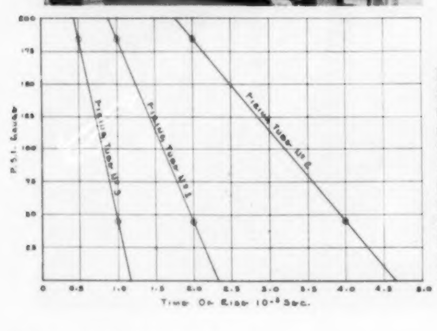


Fig. 8 Showing the time-of-rise achieved with the first (original) firing tube, and two later tubes, for various peak pressures

gas law: $p = \frac{pRT}{v}$. With a constant total volume v of 53 cu ft, a pressure rise of 185 psi (or 12.6 atm) would require the injection or production of 670 cubic ft of additional gas at ambient temperature and pressure. With heat addition alone, the same pressure rise would require enough heat to raise the temperature of the gas by some 7000 F or some 5200 Btu.

Either of these extremes would be difficult, if not impossible, within the required pressure rise times of a few millisec. The use of explosive results in additional gas, in about equal volume to the air originally present, and temperature rises of about 3000 F (for the highest loadings).

Analysis of the results of test firings shows that, when inert combustible material is kept to a minimum, calculated and observed pressure rises are in close agreement. This involves the use of a type of Primacord originally provided with an outer cover of polyethylene and a light inner case of cotton or rayon. By stripping off the outer polyethylene case before use, satisfactory results can be obtained.

The proof testing showed that, with the present firing tube, peak pressures from 20 to 185 psi can be obtained, times-of-rise from 1.0 to 2.3 millisec, and times-of-decay in the neighborhood of three sec. Fig. 8 shows the time-of-rise not only for the first firing tube just described but also for the second and third firing tubes. These calculations are based on Tube No. 2 having twice the venting area of Tube No. 1, and Tube No. 3 having one half the venting area of the first tube.

The fact that temperature increases in the main pressure vessel may be several thousand degrees indicates that cooling with subsequent pressure decrease will be rapid. For this reason it is necessary to provide an additional source of hot gas for pressure-decay periods exceeding 3.5 sec.

Conclusion

Since the completion of this Atomic Blast Simulator it has created much interest in several fields:

1 Dynamic loading of soils.
2 Dynamic loading of large structures and equipment.
3 Its application to explosive forming of metals.

During the fabrication, the men working on the Atomic Blast Simulator named it the Trojan Horse. This complex weld mount held many a surprise and trick during fabrication. The Naval Civil Engineering Laboratory people have nicknamed it the "Boyntonsaur."

The testing to date shows that it has extreme versatility in dynamic loading as to times-of-rise, peak pressures, decays, and consistent reproducibility.

Acknowledgments

The Atomic Blast Simulator is the result of the efforts of: Naval Civil Engineering Laboratory personnel, Structures Division; Boynton Associates (Wm. W. Boynton, Engineer and Director; Dr. James M. Carter, Chemical Engineer; Dr. Benedict Cassen, Physicist; Mr. C. R. Nisewanger, Physicist and Electronic Engineer; Dr. Franklin Roach, Physicist; Mr. N. D. Whitman, Structural Engineer). The steel fabrication is by National Steel & Shipbuilding Co., San Diego, Calif. The concrete construction is by B. H. Maland & Sons, Santa Paula, Calif.

Fig. 1 Problem in air conditioning—the new electronic-data-processing room in a government building. On the one hand, large, concentrated cooling loads. On the other, the need for personnel comfort. The situation was complicated by low ceilings and limited space for ducts.

Air Conditioning for an EDPM Room

By J. R. Bailey, Mem. ASME, Ass't Project Engineer, Whitman, Requardt & Assoc., Baltimore, Md.

Electronic-data-processing machines must be installed in air-conditioned rooms, with a high degree of air filtration and year-round control of temperature and humidity. They give off tremendous heat. For a building with inadequate space—a solution.

In the Candler Building in Baltimore, Md., the Social Security Administration had three EDPM rooms which were air-conditioned with five package-type air-conditioning units located around the periphery of the rooms. Air was supplied by overhead ducts and diffusers and returned through the rooms to return-air grills in the front of the units. Temperatures varied considerably over the areas, resulting in computers cutting out in some locations due to high temperatures, and complaints from operating personnel in other locations due to excessive drafts and low temperatures.

Large portable floor-mounted fans had been installed in the areas in an effort to circulate cool air to the hot spots. While accomplishing this objective, the fans had produced more drafts and complaints. In certain places, the supply air was short circuiting back to the air-conditioning units, icing the cooling coils and causing equipment shutdowns.

Due to the limited floor-to-floor height of the existing building and the necessity for a raised false floor to accommodate cable runs between machines, and space required for overhead ducts, 8 ft 0 in. was the maximum possible suspended ceiling height. Each computer had its own circulating fan which picked up cool air at floor level and discharged hot air from the top of the computers. The combination of the location of supply-air diffusers and low ceiling height resulted in improper mixing of supply air and computer discharge air, and caused the hot discharge air to short circuit back to the inlet of the computers, resulting in their cutting out on high temperature. All of these factors created a backlog of work which was practically insurmountable, since the regular work schedule required operation of the EDPM rooms 24 hours a day, 7 days a week.

Contributed by the Process Industries Division and presented at the Annual Meeting, New York, N. Y., Nov. 30–Dec. 5, 1958, of The American Society of Mechanical Engineers. Paper No. 58—A-168.

Air Conditioning for an EDPM Room

The experience gained while trying to alleviate the deficiencies of the existing air-conditioning systems proved invaluable when designing the air-conditioning system for a new, recently constructed EDPM room for the Social Security Administration in the Candler Building, as well as for EDPM rooms in the new $25,000,000 building now under construction.

Approach to New Design

The area allotted for the new or second EDPM room in the Candler Building had the same shortcomings as the existing area; namely, low floor-to-floor height with the necessity of a raised false floor to accommodate cable runs which, again, resulted in a ceiling height of 8-ft 0-in. The new area was also much smaller in relation to the amount of electronic equipment, resulting in an even higher concentration of heat. The main problems again were: Proper air distribution to insure even temperature and humidity conditions over the entire area; to eliminate short circuiting of air from computer circulating fans; to eliminate drafts to increase the comfort of operating personnel; and to provide a year-around air-conditioning system that would have a minimum of breakdowns.

The new room (Fig. 1) has an area of 2300 sq ft with a total cooling load of 60 tons. 40 tons of this is heat given off by electronic equipment with the remainder due to lights, conduction, fresh air, and operating personnel, resulting in a 98 per cent ratio of sensible to total room heat. The room design condition to be maintained is of 75 F dry bulb with an allowable variance of 2 F, and 50 per cent relative humidity with an allowable variance of 5 per cent.

Under these conditions the maximum temperature difference between dry-bulb temperature and supply-conditioned air that could be obtained was 18 F even by using a recirculating sprayed cooling coil. To condition this room by the ordinary overhead ductwork system would have required 80 air changes per hour and undoubtedly would have produced excessive drafts.

To reduce the amount of air circulating in the room, the computers with the highest heat gain were lined up along one wall. A built-up air-handling unit supplied conditioned air in an amount equal to the combined capacity of the computer circulating fans. The supply ducts are installed under the raised false floor and are connected directly to the bottom of the computers. The hot discharge air from the computers is collected by hoods connected to the ceiling return ducts which convey the air back to the built-up handling unit (Figs. 2, 3).

The computer manufacturer's requirements for air entering the machines are: Maximum relative humidity of 60 per cent, minimum relative humidity of 40 per cent, and maximum dry-bulb temperature of 80 F. The underfloor system is designed to deliver 13,800 cfm of air at 66 F dry bulb and 59 per cent relative humidity. The air is heated as it passes through the machines with a resulting lowering of the relative humidity, and the air therefore is delivered at a relative humidity close to the maximum allowable in order to obtain the best average conditions through the machines. The 66 F dry-bulb temperature was determined by refrigerant equipment and could have been set anywhere between the maximum allowable temperature of 80 F and a minimum temperature equal to the room dewpoint

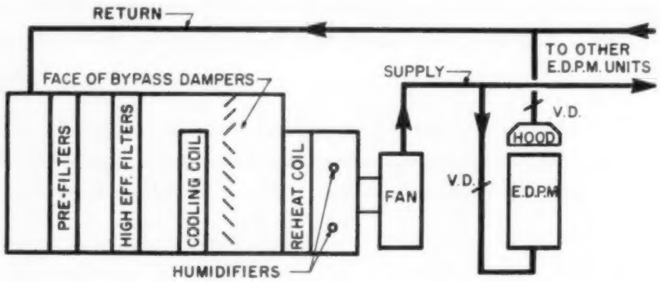


Fig. 2 The air-conditioning system for the computers, designed to meet the specified requirements for air entering the machines. Problem: Keep the air as cool as possible without condensation on the machines from room air.

Fig. 3 To condition this room by the ordinary overhead ductwork system would have required 80 air changes per hr, and undoubtedly would have produced excessive drafts.

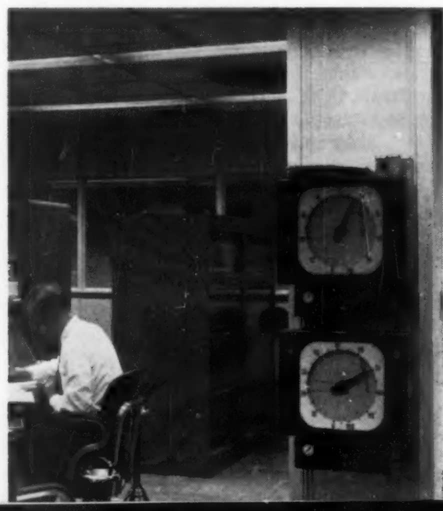


Fig. 4 Control must be quick. Electronic temperature and relative-humidity controllers give instantaneous response to fluctuations in load, resulting in highly accurate control.

temperature, to prevent condensation on the machines from room air.

Because of the combination of slow response inherent in most pneumatic and electrical controls and the possibility of rapidly changing delivery air temperatures and relative humidities, electronic temperature and relative-humidity controllers (Fig. 4) are used to control the dry-bulb temperature and relative humidity of the conditioned supply air to the computers. This built-up air-handling unit consists of standard throwaway prefilters, high-efficiency throwaway filters, a direct-expansion cooling coil with bypass, face and bypass dampers, steam reheat coil, steam grid humidifier, and supply-air fan.

The remainder of the heat load produced by small calculators, lights, people, conduction, and radiation from hooded computers is conditioned by another built-up air-handling unit (Fig. 5) consisting of standard throwaway prefilters, direct expansion recirculating sprayed cooling coil with moisture eliminator, steam reheat coil, and supply-air fan. The air-handling unit is designed to deliver 13,700 cfm of conditioned air at 56 F dry-bulb and 55 F wet-bulb temperature.

Supply air is distributed by ductwork located above the ceiling and is discharged through adjustable-pattern air diffusers sized and located to suit the load requirements and to minimize drafts. The limited space above the ceiling prevented an above-ceiling installation of return ductwork so the ceiling space itself was used as a return air plenum with return registers located directly in the suspended ceiling. The air-handling unit is controlled by a room thermostat and humidistat to maintain room design conditions.

The only unknown heat load was the radiation from hooded computers, and this was assumed as 20 per cent of the entire heat load of the hooded computers. The effect of using 20 per cent radiation compared to 0 per cent radiation was to increase by 25 per cent the amount of air supplied by the overhead system.

The overhead system supplies the only air which is felt in the room and is equal to 45 air changes per hr instead of the 80 air changes per hr which would have been required to condition the area without using the underfloor system.

The remainder of the air-conditioning system consists of two 60-ton condensing refrigeration compressors with one as a standby, a 100-ton (to include future requirements) inside-installed cooling tower for a year-around supply of condenser water, and two condenser-water pumps with one as a standby. Two views of the installation are shown in Figs. 6 and 7.

The total cost of the air-conditioning system, including electrical services to mechanical air-conditioning equipment, was $67,000. All other related work including partitions, raised floor, suspended ceiling, lighting fixtures, etc., was done by the government's maintenance force.

Conclusion

To date, the above installation has been in operation 7 days a week, 24 hr a day, for a period of over a year without a single stoppage due to air-conditioning equipment failure or computers cutting out due to high temperatures, and without a single complaint from operating personnel because of drafts or uncomfortable conditions. It is felt that this type of air-conditioning system provides a way to achieve excellent results for an EDPM room, both from the standpoint of adequate cooling of computers and operating personnel comfort, especially if the room has large concentrated cooling loads, low ceiling, and limited space for ducts.

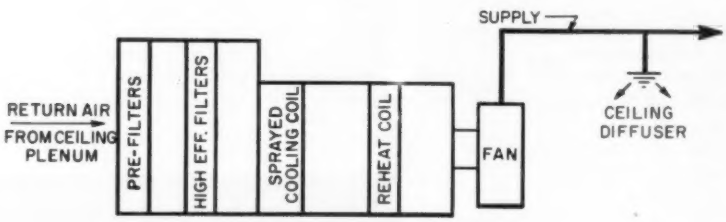


Fig. 5 The overhead air-conditioning system, taking care of the heat load produced by small calculators, lights, people, and radiation from the hooded computers

Fig. 6 An air-handling unit, showing steam piping to reheat coil, refrigerant piping to cooling coil, motors for face and by-pass dampers, access doors, and static-pressure gages for air filters

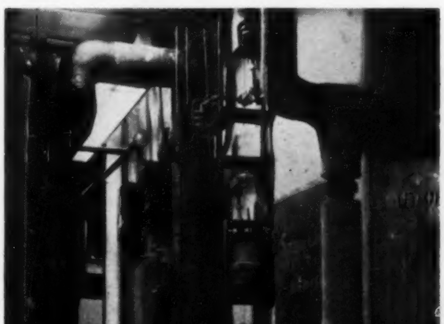
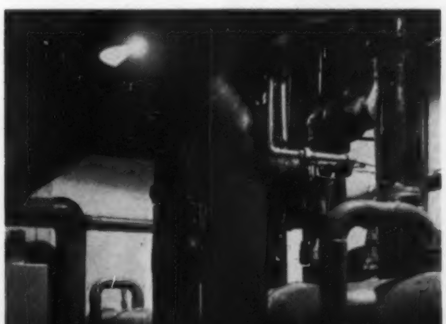


Fig. 7 In the background, a refrigeration machine with centrally located electric motor driving compressors on each end. A water-cooled condenser is mounted above.



Abstracts and Comments Based on Current Periodicals and Events

D. FREIDAY
Assistant Editor

BRIEFING THE RECORD

Plasma-Arc Plating Service

A PROCESS which uses controlled temperatures up to 30,000 F to fabricate shapes and apply coatings that will withstand +5000 F is available on a service basis from the Linde Company, a division of Union Carbide Corporation.

Key to the method is the Linde-patented Plasma-Arc Torch, a device less than 2 in. in diam. An annular layer of cool gas keeps the nozzle of the arc from being consumed by the high temperatures generated by forcing the electric-arc column to operate within a small-diameter tube. Refractory metals, their compounds and alloys, prepared in wire or powder form are fed into the intense arc struck inside the torch, and converted into a fluid or plastic state. The material is then carried out of the torch by inert gases flowing at high velocity and deposited on the part being made or plated with such force that a firm bond results.

The bonds are generally chemical and mechanical in character and far exceed those obtained by electroplating, vapor deposit, or metal spray. The coatings are dense, usually laminar in structure, and capable of being finished to below 10 microin.

The plasma-arc torch is being used to make parts by depositing a coating to the required thickness over a precisely made brass mandrel. When using tungsten, the metal at this stage has a density of 94 to 95 per cent, a modulus of rupture of 44,000 psi, and a Young's modulus of 22×10^6 psi. An acid bath which attacks only the brass is used to remove the mandrel. The shape is then fired in an inert-atmosphere furnace for 2 hr at 1400 C. After firing, the density is increased to 97 or 98 per cent, the modulus of rupture to 57,000 psi, and Young's modulus to 34×10^6 psi. The volumetric and linear shrinkage upon firing are 2.2 per cent and 0.7 per cent, respectively. Very low figures compared to those obtained with tungsten formed by other processes.

Plasma-arc coatings have another good area of application in the production of refractory parts such as crucibles for high-melting-point materials. Torch-formed parts can be made structurally sound without resorting to heavy walls. They are dense and can be made with high surface finishes. Crucible-wall thickness normally is in the 0.125 to 0.250-in. range, but with plasma-arc methods these can be 0.040 to 0.060 in.

Special parts for nuclear work, sensitive electrical contacts, and electronic components, and x-ray targets of superior density are other applications, along with experimental rocket and missile parts of pure tungsten or tungsten-coated graphite.

Although the plasma-arc torch is a new development in the fabrication field, it has been used for some time in advanced research. Set up as a wind-tunnel tool for

A heat-resistant tungsten coating is applied to a missile nose cone with the Plasma-Arc Torch which harnesses the highest temperatures used in industry—between 15,000 and 30,000 F

Particles in a plastic state are deposited at near-sonic velocity by a wire-fed torch which moves back and forth on a traverse

either large or small units, it can simulate speeds up to Mach 20, and the shock waves that are formed are visible to the naked eye.

An experimental high-current d-c arc torch is now being used by Linde to explore problems involved in using electric power above 10,000 amp. This will result in concentrations of power equivalent to 3 megawatts per sq in.—equal to putting the total output of the largest electric generator into a 6-in-sq area.

The pattern of fluid flow past a single turbine blade is made visible by injecting air bubbles in a new water tunnel at the Westinghouse Research Laboratories, allowing three-dimensional viewing of either stationary or rotating structures under actual operation

Plasma Thermocouple

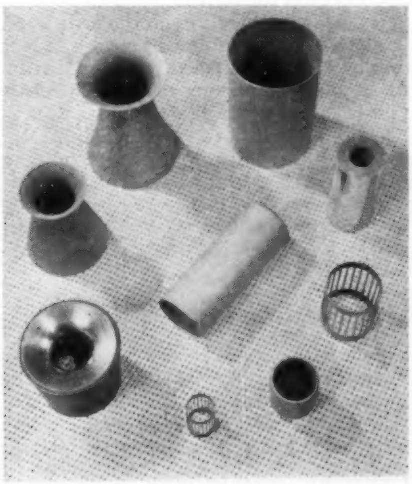
A PLASMA THERMOCOUPLE, a new generator that has no moving parts but converts heat directly into electricity, brings considerably closer the direct removal of nuclear-reactor heat in the form of electrical energy.

The plasma thermocouple has been developed by five scientists at the Los Alamos Scientific Laboratory operated by the University of California for the Atomic Energy Commission at Los Alamos, N. Mex. Possible future uses of the device include providing current for homes and factories, for instruments in artificial satellites, and for applications in interplanetary propulsion.

The novelty of the plasma thermocouple is that it uses an electric plasma—a "fourth state of matter" which is currently attracting the interest of physicists. A normal thermocouple employs two kinds of metal, fused together. The new one employs only one metal, the other being replaced by the plasma, an ionized gas. By this means, the Los Alamos scientists have been able to produce a thermoelectric generator which acts continuously, with a steady input of heat energy and a large steady output of electrical energy.

Lockheed Fuel Cell

A FUEL CELL in advanced development at Lockheed Missile Systems division laboratories, Sunnyvale, Calif., has repeatedly achieved almost 100 per cent of fuel utilization and energy conversion efficiencies of 70 per cent or better, in laboratory experiments. This compares with a conversion efficiency of 35 per cent for steam engines and even less for internal-combustion engines.



Ultra-high temperature materials that have been virtually unworkable can be coated over a brass mandrel later dissolved

Water-Tunnel Research

A UNIQUE "water tunnel," which permits three-dimensional studies of fluid motion around complex structures, is helping Westinghouse Electric Corporation perfect designs for steam turbines, large ventilating fans, and other rotating equipment.

Essentially, the water tunnel serves the same purpose as a wind tunnel, although it is smaller and uses a liquid medium rather than air. Tiny air bubbles, oil droplets, or small particles of plastic are injected into the water stream to make the flow pattern visible. The temperature of the entire 13 tons of water in the tunnel is adjustable from room temperature up to 150 F.

The tunnel allows engineers to study fluid flow around a structural model or machine component. Flow patterns around a simple structure, such as a sphere, can be calculated comparatively easily. However, mathematical analysis is too cumbersome for intricate structures, and the water tunnel provides needed development information. Flow studies can be made of both stationary and rotating models. Fluid travel can be observed past all the surfaces of a complex rotating structure under actual operating conditions.

Because water is more dense than air, a water tunnel will produce the same flow patterns when moving only about one thirtieth as fast as air. For example, a turbine blade rotated in water at 200 rpm will simulate the same conditions as when rotated in air at 6000 rpm. Also, there is no satisfactory way to see highly turbulent flow around closely spaced objects in a wind tunnel, whereas a water tunnel makes it readily visible.

The water tunnel is actually a vertical pipe, about 2 ft in diam and 20 ft high through which 13 tons of water move at 8000 gpm. One section of the pipe is made of clear plastic, inside which the model being studied is mounted. A $7^1/_2$-hp electric motor rotates the model, and a 30-hp electric-motor-driven propeller pump is used to force water through the pipe.

A peak-power diesel generating unit developed by Electro-Motive Division of General Motors consists of packaged units. One contains controls and switchgear to be used with one to three 2000-kw generating units.

Peak-Power Diesel Generating Unit

Four years ago, finding the domestic market for diesel-electric locomotives approaching saturation, the Electro-Motive Division of General Motors began looking at the market for peaking-power plants. The field also fit in with the company's experience in building 30,000 diesel-electric locomotives—essentially power plants with a total capacity of 30 million kw. The first plant introduced was a 1000-kw unit.

Although the industry was first amused by the 1000-kw units and contemptuous of them, it became increasingly conscious of the peaking problem. An industry study of desirable specifications indicated that ideally such plants should be 5000 kw, self-contained, portable, require a minimum of installation, be automatic, unattended, self-protected, quiet, clean, and good neighbors generally.

EMD has produced a new model MU60 plant which will produce up to 6000 kw in multiples of 2000 kw. Minimum unit is one 2000-kw generating unit, and a unit containing the controls and switchgear. Two additional power units can be added without adding additional control units.

Each of the units is contained in its own steel, weatherproofed, sound-deadening housing. Installation consists of providing a stone-and-railroad-tie or concrete base, coupling the cable, and providing a fuel tank. The entire plant, with transformers, will occupy an ordinary city lot, and sound level is so low (80 db at 100 ft) that it blends with street-traffic noise.

Each generating unit weighs about 50 tons, each control unit about 17 tons, and either can be shipped on a standard flatcar and transferred to a lowboy trailer for hauling to the site.

Plants are ready to operate on any reasonable site in the U. S. 10 days after leaving the factory, at a price of $85 FOB La Grange, Ill. Allowing $15-per-kw installation cost, they will still meet the industry requirement for a total cost of less than $100 per kw. Actual installation cost for the prototype plant, which had been in operation about 60 days at the time of the announcement, was $28,374 plus the cost of the land, representing an installation cost of about $5 per kw for the 6000 kw.

Within 35 to 40 sec of pressing the start button, generators are synchronized and ready to go on the line. Plants can be operated by time-clock starting and stopping, by central-dispatching-station command, or a combination of methods.

The generating system is a semisealed design and requires no regular or routine maintenance. The diesel equipment is designed and arranged for minimum maintenance and is readily accessible for inspection and servicing. Service contracts are available for those unfamiliar with diesel operation.

New Packaged Boilers

A line of natural-circulation pressure-fired packaged boilers, capable of generating steam at capacities up to 100,000 lb or more per hr, has been placed on the market by The Babcock & Wilcox Company.

The new units operating on either oil or gas or a combination of the two fuels in the 250 to 775-psi range are known as B & W Package Boilers, Series 100-OG, and are expected to cost approximately 20 per cent less than field-erected units of similar capacities.

The reduction is made possible through the utilization of the natural-circulation principle of operation. This eliminates the need for such equipment as recirculation pumps and reduces over-all maintenance requirements and subsequent costs. Initial refractory costs as well as recurring maintenance expenditures are also minimized.

Among other features are the arrangement of tubes in the convection bank with alternate wide and narrow spacing to facilitate replacement and more effective soot blowing, and to permit the use of B & W cyclone steam separators.

All-Aluminum Refrigerator Cars

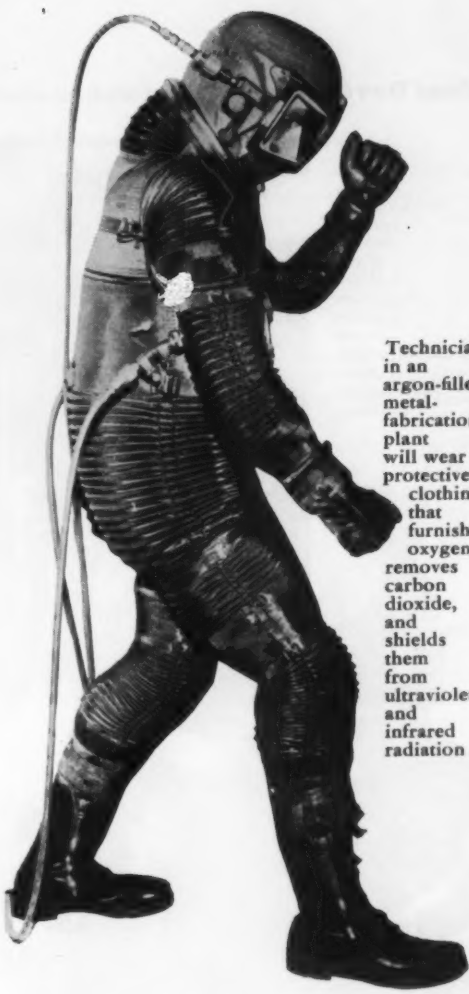
Five all-aluminum refrigerator cars are now in service with the Canadian National Railways. Designed by the CNR, Aluminum Company of Canada, Ltd., and National Steel Car, and built by the latter, they are 22.5 per cent lighter (14,200 lb less) than previous refrigerator cars.

With the exception of the trucks, charcoal heater, door and hatch hardware, and certain safety equipment, all parts of these five cars are of aluminum construction. The purpose of this extensive use of aluminum is primarily to eliminate expensive and frequent repairs and repainting due to brine-solution corrosion.

The five prototype units will be subjected to an extensive testing program. Four cars now in CNR service are being observed in normal operation. Strain-gage readings and deflections will be recorded in static and operational road tests for various conditions of road, both on the meat rack and on the floor of the fifth car.

On completion of the road test, Aluminium Laboratories, Ltd., in Kingston, Ont., will undertake fatigue and impact tests.

Results will be compared with the stress analysis which preceded the design, and areas of over or under-design can be corrected in future cars. The extensive test program is expected to eliminate the customary 5 to 10-yr service-testing requirements on new equipment.



Technicians in an argon-filled metal-fabrication plant will wear protective clothing that furnishes oxygen, removes carbon dioxide, and shields them from ultraviolet and infrared radiation

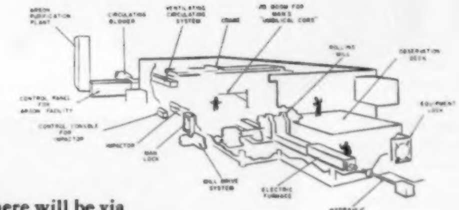
Argon-Filled Plant

Plant technicians in a full-sized metal-fabrication plant sealed within a building filled with argon gas, will wear specially-designed "space suits" as they work on the rolling mill, crane, and impactor within the giant sealed room. The plant is being built within a 40 × 80 × 22-ft building composed of $^3/_{16}$-in. welded steel sheets.

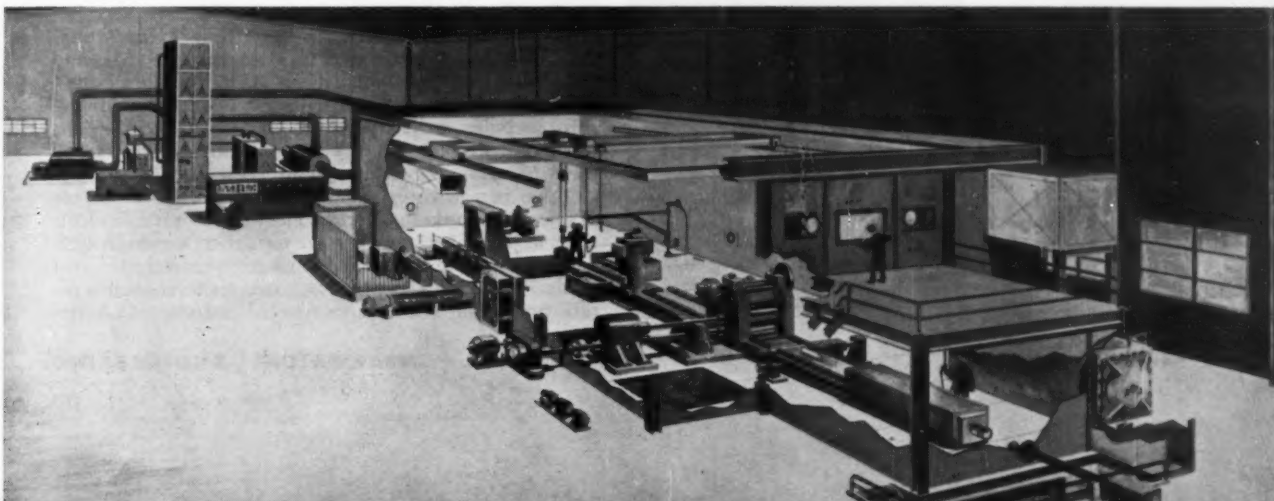
The $3-million plant, to be completed within a year, is being built by Universal-Cyclops Steel Corporation, Bridgeville, Pa., for the Industrial Planning Division of the U. S. Navy Bureau of Aeronautics.

The workmen's space suits are connected to hoses that feed conditioned air and exhaust carbon dioxide outside the facility to prevent contamination of the 99.995 per cent pure argon gas within the sealed plant. Three personnel locks, one equipment lock, and a material lock are required to maintain the purity of the argon atmosphere.

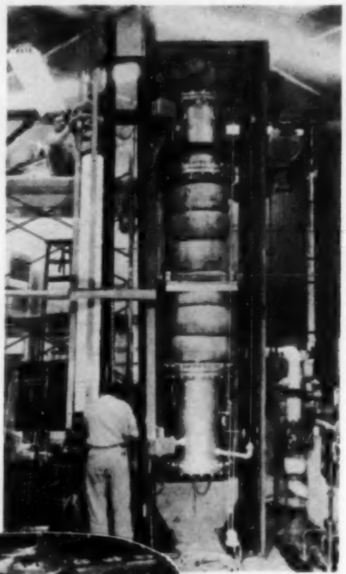
Ingots of such metals as columbium, tantalum, molybdenum, and tungsten—which instantly react to the earth's atmosphere at the high temperatures needed for successful fabrication—3000 to 5000 F—will be processed into billets, bars, sheet, and forgings, then coated to prevent oxidation and nitridation before being exposed to the ordinary atmosphere.



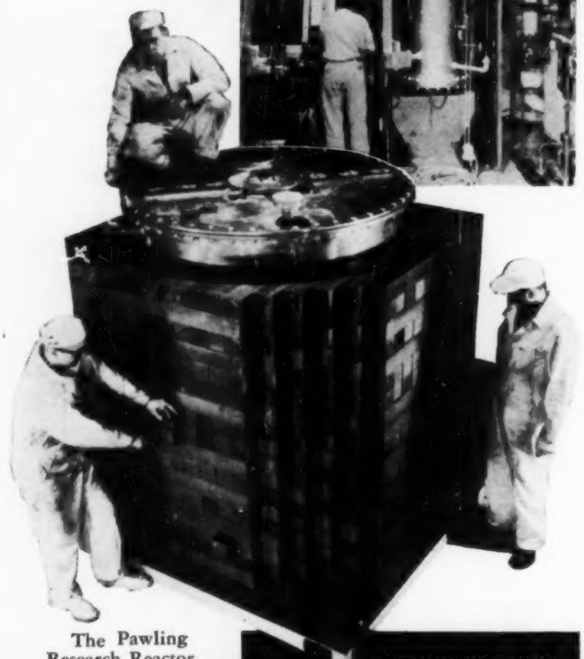
Access to the sealed plant with its 99.995 per cent pure argon atmosphere will be via personnel and equipment locks. Columbium, tantalum, molybdenum, and tungsten will be processed in the plant and then coated to prevent atmospheric oxidation.



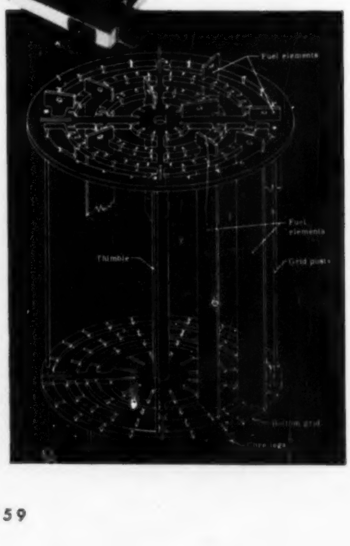
Nuclear Development



Mockup of a vertical section of the Sodium Deuterium Reactor core encompassing three fuel-element positions



The Pawling Research Reactor is a greatly simplified unshielded heavy-water-moderated design for mass production



The simplified core of the PRR uses uncaged sandwich-type fuel elements

New York State's first privately owned nuclear reactor went critical at 11:07 p.m. on Nov. 5, 1958, at Nuclear Development Corporation of America's Pawling, N. Y., laboratories. The reactor, designed for normal operation at 5 watts with occasional operation up to 100 watts, is thermal, heavy-water-moderated and reflected, and is fueled with fully enriched, MTR-type, aluminum-clad uranium-aluminum plates.

Known as the Pawling Research Reactor, it is a prototype of a teaching and research reactor which NDA will "mass produce" for the training of industry personnel in reactor operation and nuclear technology, and for university use.

Unique among reactors, it is unshielded and observed by closed-circuit television from the next room. Plate-type sandwich fuel elements are uncaged, and the D_2O has an "efficiency" of delivery of neutrons of almost 100 per cent. The reactor has an available high-flux-experiment region of over 80 cu ft. All designs, including process systems, have been greatly simplified.

The control elements are vertical cadmium plates attached to steel rods and housed in thimbles passing through the reactor-tank cover plate. The steel rods are connected to rack-and-pinion arrangements which are driven by variable-speed reversible motors. The same basic control element is used for both shim safety rods and for fine control. Position indicators and limit switches are provided, and the reactor is scrammed by gravity drop against pneumatic pressure in place of dash pots. Heavy water is simultaneously dumped.

AEC Heavy-Water-Concept Study

NDA is also nuclear-design subcontractor for Sargent & Lundy in the design study of a heavy-water-moderated nuclear power plant for the AEC.

The study will be the basis of an AEC report to the Congressional Joint Committee on Atomic Energy by April 1, 1959. It represents a continuation of developmental work conducted by E. I. du Pont de Nemours & Company, Inc., since 1956, and certain design work. Du Pont will continue part of this work, developing, designing, and constructing a Heavy Water Components Test Reactor for testing prototype fuel elements and other components of the system at a cost of approximately $8 million.

NDA has studied a large number of heavy-water reactor systems and three of its major reactor designs contain heavy-water moderator. In addition to the Pawling Research Reactor and the Sodium Deuterium Reactor being developed under the AEC Power Reactor Demonstration Program for construction in the Chugach Electric Association System in Anchorage, Alaska, they have conducted a feasibility study of the Steam Water Reactor with the East Central Nuclear Group. This would use heavy-water moderator, natural-uranium fuel, and superheated-light-water steam in a direct-coolant cycle.

A vertical section of the Chugach reactor comprising three fuel-element positions has completed over 1100 hr of successful operation and has demonstrated the feasibility of employing sodium and water in close proximity. Adequate surge volume and oxygen exclusion by means of inert-gas blanketing are the most important considerations in preventing shock-wave formation and high-temperature peaks in the event of a reaction between the two fluids. Barrier and structural-materials tests with separate and simultaneously controlled sodium and water

leaks have demonstrated that a barrier system can be designed which will maintain the segregation of sodium from water in the event that leaks develop in either or both of the primary containers holding these fluids. A duplex barrier would be conservative, but a single barrier is adequate and preferred, although a few minor design changes may be necessary to accommodate thermal distortion.

NDA Operations

NDA now has three separate locations—an office building in White Plains, a research laboratory at Eastview near White Plains, and an entire valley near Pawling, N. Y. The Pawling site was carefully chosen, with hills high enough to provide containment in the event of an explosive incident, and a lake large enough to provide cooling if a major reactor prototype should be constructed on the site. Since it takes $3^1/_2$ months for runoff to drain the lake, an added safety factor is provided if the water should become accidentally contaminated.

Largely employee-owned, the company takes great pride in its ability to compete on an even basis with the largest competitors in the nuclear field. It even regards shoestring operation as an asset—"You get so used to saving your own money that you design to save the customers money, too." The extreme simplicity of the reactor designs, and some of the shortcuts made in hot-lab equipment without sacrificing safety, bear them out.

Missile Miscellany

▶ Satellite Observatory

A SATELLITE observatory for getting an unobstructed, 24-hr-a-day look at the sun, has been designed by a St. Louis Aircraft Manufacturer, according to Leo Goldberg, chairman of the University of Michigan's department of astronomy.

The satellite observatory, scheduled for intensive laboratory experimentation, would circle 400 miles above the earth and avoid interference by the earth's atmosphere.

The entire instrument package would weigh less than 300 lb and include a stabilization and control system for precision pointing of instruments at the sun, power supply, and equipment for recording data and transmitting the information upon command from earth.

▶ Miniaturized Tape Recorder and Data Transmitter

A tiny rugged tape recorder weighing only 8 lb and measuring 9 in. long, 5 in. high, and $4^1/_2$ in. wide, developed by Lockheed's Missile Systems Division, is one third smaller than existing recorders with the same capacity. It can function at unlimited altitudes and in any position or axis.

It can record and store vital data and then transmit them at an accelerated rate on a command signal when the vehicle returns within radio range.

It is built with such precision and ruggedness that it has survived simulated rocket launches of 50 g, the equivalent of crashing a plane into a concrete wall at 1100 mph.

Fully transistorized, the entire electronics system requires only 10 watts, and the power is turned on only when the recorder is in actual operation.

Nuclear Briefs

▶ Most Economical Nuclear Power Stations

THE ATOMIC ENERGY COMMISSION has received 86 proposals from 32 architect-engineering firms for performance of preliminary design, engineering, and cost studies directed to nuclear power plants employing three reactor concepts of proved technology—the boiling-water, pressurized-water, and organic-cooled. Separate cost-plus-fixed-fee contracts will be awarded for each study.

Purpose of the studies is to determine what design variation would provide the most economical nuclear power station for each of the three types. Consideration will be given to the present status of nuclear technology, projected power requirements, the characteristics of available generating equipment, and the possibility of a start in construction on the first unit of each type by a private or public organization in the United States or abroad by July, 1960.

▶ Survey of Industrial Participation in Atomic Energy

The Bureau of the Census, Department of Commerce, with the co-operation of the AEC and the Defense Services Administration, is collecting statistical information to determine the extent of U. S. industrial participation in the over-all program for the peaceful uses of atomic energy.

A comprehensive survey is being made of the development, growth, and status of the atomic-energy industry, private and public, including the number and value of shipments, the manufacture of atomic-energy products, and the processing of raw materials and by-products will be published annually as a report of the Census of Manufactures.

▶ U. S.-Euratom Agreement Signed in Brussels

The Agreement for Co-operation in the civil uses of atomic energy between the United States and the six-nation European Atomic Energy Community (Euratom) already given general approval by both houses of Congress (MECHANICAL ENGINEERING, October, 1958, p. 78) was signed in Brussels in November. The agreement has as its major objective the bringing into operation in the Community in the next 5 to 7 yr of approximately 1,000,000 electrical kw of nuclear power using reactor types developed in the United States.

▶ Sixth British Nuclear Power Station

The Central Electricity Generating Board will apply to the Ministry of Power and to the Local Planning Authority for consent to develop a site at Sizewell on the North Sea coast in East Suffolk.

According to *The Steam Engineer*, the proposed power station will have an output capacity of about 650,000 kw, and the site is capable of further development. The station would be connected to the 275-kv national-grid system.

The plant is in addition to Calder Hall and the four stations planned or under construction (MECHANICAL ENGINEERING, February, 1958, pp. 60–63), and a fifth at Trawsfynydd, Merionethshire, on which preliminary work has begun.

Tiny contactless thermal switches protect electric motors against overheating

Electric Motor Overheat Protection

A SIGNIFICANT new family of solid-state devices that serve as tiny contactless thermal switches has been developed by Westinghouse. They are thermistors of a new type, whose resistance increases abruptly when a specified desired temperature is attained.

They have many applications where it has been impractical to use bimetallic temperature-sensing elements.

The thermistors are installed directly in the motor windings of hermetic motors in large air-conditioning and refrigerating systems and will operate a small external relay which de-energizes the motor or gives a signal when overheating occurs. This is the only protective system so far developed that is inherently failsafe. Westinghouse expects to market hermetic motors with the new protective system shortly.

The new thermistors display an abrupt and substantial increase in resistance when their temperature rises to a specified point and return to nominal resistance value when cooled below that point. As high-resistance circuit elements with no moving parts, they perform the function of a switch by effectively opening the circuit. When their temperature falls below the critical point, their resistance returns to a quite low value, so that they act as a conductor to close the switch.

The new devices are termed Positive Temperature Coefficient Thermistors to indicate that their resistance increases with temperature in contrast with conventional thermistors whose temperature coefficient of resistance is negative.

Specialized Ball Bearings

THE Barden Corporation, Danbury, Conn., a small developmental concern left with good engineering and manufacturing know-how at the end of World War II, examined the civilian needs for specialized small-lot production of ball bearings. Prewar ball bearings were principally mass-produced items of relatively limited types with a minimum of research and development.

Since bearings for the Norden bombsight were one of the first government contracts undertaken by Barden, the gyro-synchro-servo field made a natural area for the company's principal fields of operation. Other small bearings are made for special requirements in sizes down to $^1/_4$-in. OD. One bearing for instrument use is only 0.020 in. thick, and finishes on supercritical bearings are almost as accurate as those for gage blocks, with tolerances of 20 millionths or better for all dimensions except balls, which are kept to 5 millionths or better.

The company is still a leader in bearing research and development, and is now working on bearings for the gas turbines which are in the experimental stage for automotive application. The aviation and missile requirements are pushing bearings to new temperature highs—800 F is now practical; and gyro drifts for inertial-guidance components are being reduced to 1-millionth in. Bearing wear is a major problem in gyros because any addition of lubricant changes the mass distribution.

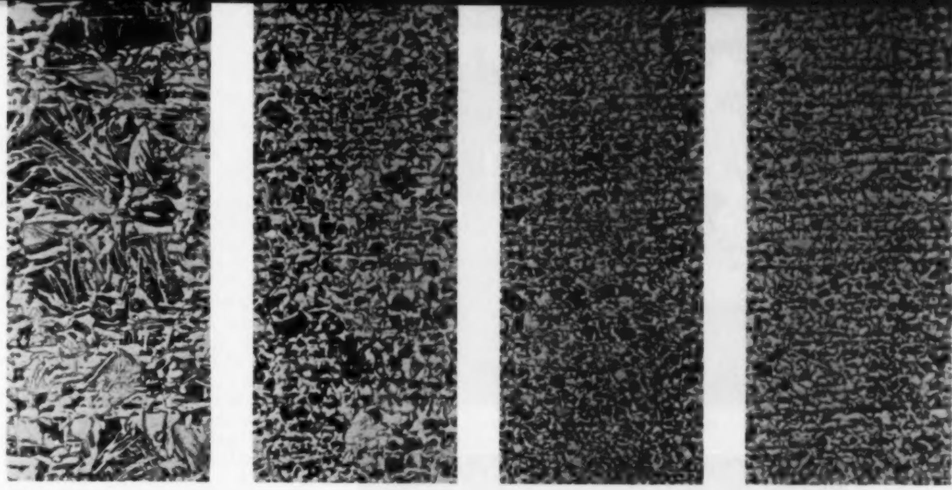
The company has now adapted itself so well to the specialized sales, manufacturing, and research requirements of the field that it is no longer retrenching, has just dedicated a \$2.5-million plant, and is looking for new areas to tackle with its all-engineer sales force. Engineers are required for sales since bearings are specified at the blueprint stage and salesmen must understand the design engineer's problems.

Production consists largely of manual assembly of minute components in job-lot quantities with extreme precision, largely women's work. No balls are manufactured although some are upgraded. All critical and supercritical assembly is in electrostatically cleaned and otherwise conditioned air. Plus pressure is maintained to provide leakage out of these areas, rather than seepage in of dust-laden air.

Standards are so critical that the ratio of production to inspection personnel is unusually high—3 to nearly 2. There are operator checks, shop-floor surveillance checks, preassembly parts checks, and final performance tests.

Final assembly of precision instrument bearings, following thorough washing with triple-filtered solvent, is done under hoods that provide additional filtration and outward pressure of air to prevent dust from entering

Effect of columbium: *Left to right:* no columbium; columbium added; columbium addition doubled; columbium addition tripled. Grain refinement produces higher yield strengths and increases toughness in the new weldable GLX-W steels.



Columbium-Treated Mild-Carbon Steel

Great Lakes Steel Corporation, a subsidiary of National Steel, has announced the first commercial columbium-treated mild carbon steel—a fine-grained steel with the strength, toughness, and weldability of heat-treated steels.

Columbium—also known as niobium—is a metallic element occurring chiefly in niobite or columbite, an oxide mineral. There are large deposits near Montreal, Canada. Welding difficulties encountered with early stainless steels were solved by the use of columbium.

Now, using columbium, Great Lakes has a tough, formable, weldable steel in a position between carbon steel and low-alloy steel. They expect it to make substantial reductions in the cost of thousands of products—a special boon, they believe, to producers of heavy mobile equipment such as tractors and trucks. Ton-for-ton it costs more; but its high strength will permit the product to be made with less steel—a net saving due to more product per ton.

The company states that the increased strength of the GLX-W series of steels is obtained without increased brittleness because the columbium treatment produces a fine-grained internal structure. Previously, this grain structure has been obtained by the use of expensive alloying elements in substantial quantities and by various heat treatments. The structures shown in the illustration were attained in low-cost semikilled steels.

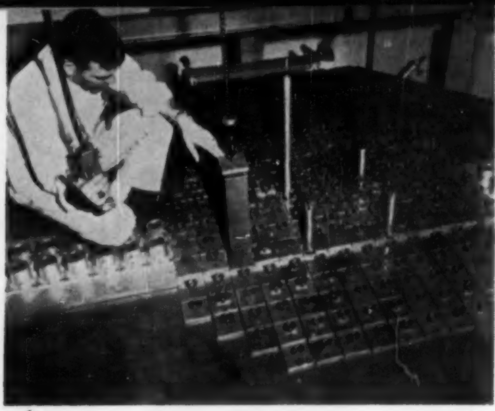
The GLX-W steels in hot-rolled plate are offered in grades showing yield points from 46,500 psi to 63,020 psi, where the yield point of the untreated steel was 36,580. Tensile strengths range from 70,400 to 82,240 psi, with elongation declining from 43 to 34 per cent. Charpy V-notch tests are reported showing toughness ranging from 20.0 to 30.0 ft lb at −20 F, and from 3.0 to 7.0 ft lb at −60 F.

High-Capacity Meter Testing

A major roadblock to general application of high-capacity petroleum meters—units capable of metering more than 2000 gpm—has been removed with the opening of a special 10,000-gpm test facility, by Rockwell Manufacturing Company, Murraysville, Pa.

The trend in the petroleum industry and among other liquid-meter users is toward the use of the higher capacity meters, so that the larger unit volumes of liquid product shipped can be metered rapidly and accurately to facilitate turnaround, particularly where crude is shipped in supertankers of 60,000 tons or larger.

An air-handling system screens out dirt and dust and maintains air at 75 F with maximum humidity of 40 per cent in the assembly section of the Barden plant in Danbury, Conn. All openings in ceilings and walls are sealed and gasketed and parts and materials enter critical area via pass-through in walls.



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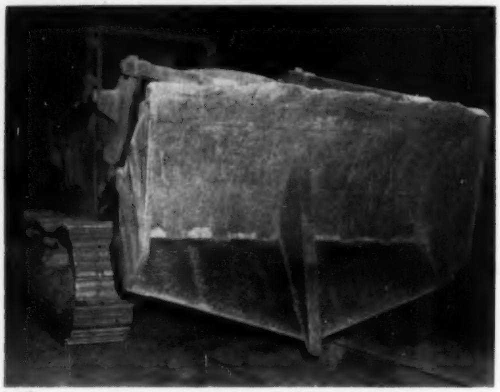

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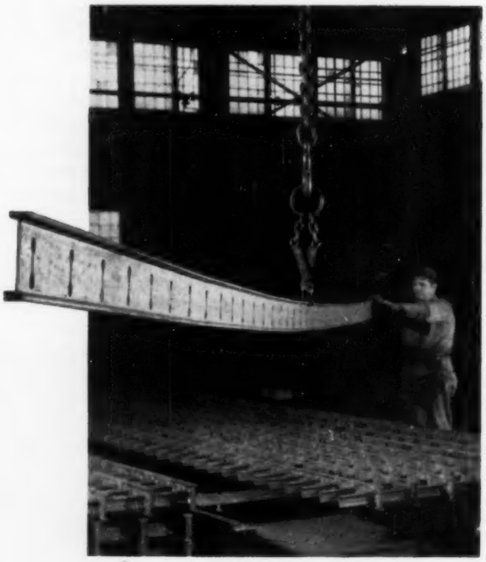

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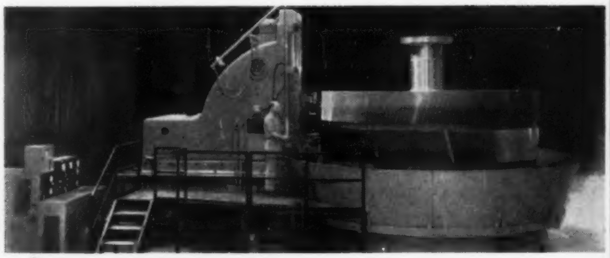

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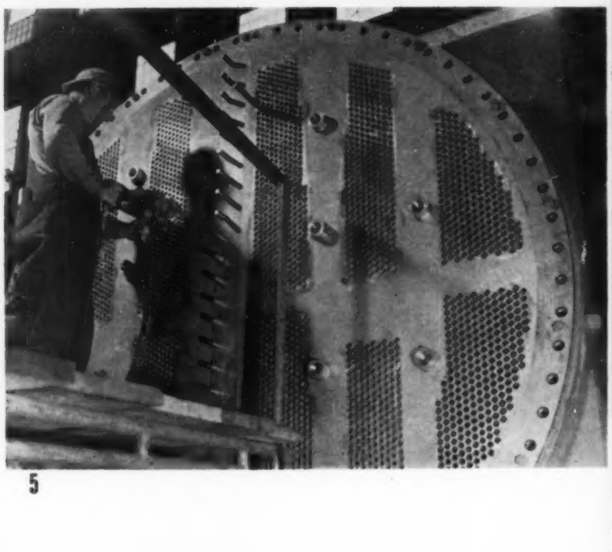

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1 Critical Assembly. "Dummy" fuel elements are inserted into Babcock & Wilcox's critical assembly at the company's Critical Experiment Laboratory in Lynchburg, Va., to check alignment and loading procedures. The facility consists roughly of a "pile" of graphite and bismuth blocks of assorted shapes and sizes for research on the liquid-metal-fuel reactor. The core is composed of strips of enriched uranium alloy fastened to bismuth bars. Half of the assembly is on a stationary table, and the other half on a movable base.

2 Tooth for Hot Slag. A tough "tooth" of United States Steel's T-1 steel combined with a V-shaped bucket "lip" of the same high-yield-strength alloy is used to chew up hot slag at the company's Homestead District Works. Formerly replaced every three weeks at a cost of $3000 units now last three months.

3 Beam Camber Compensates for Weld Distortion. Each of the ten 26-ft 5-in. I-beams used in flooring for the Greater New Orleans cantilever bridge is clamped in a welding fixture and the camber is partially pulled out by adjusting 70 hold-down clamps; then 36 cross members are inserted through the punched holes and each intersection is manually welded all around with Lincoln Electric Company equipment.

4 Vertical Gear Shaver. A king-size Gear Shaver developed by Michigan Tool Company of Detroit operates with extreme precision—the supporting table rotates within 0.0002 in. of concentricity and is accurate within 0.0002 in. of runout in the flat plane of rotation. It can finish either internal or external spur, helical, or herringbone gears with or without integral shafts having diameters from 80 to 200 in. and face widths up to 74 in.

5 Welded-Tube Condenser. Tubes are welded rather than rolled into tube sheets in a new technique developed by Allis-Chalmers Manufacturing Company to achieve the tightest possible joints between tubes and tube sheets.

6 Four Machines in One. A specially designed three-spindle Heald Machine Company model 221 Bore-Matic machine performs the work of four formerly separate machines. It has a two-station hand-clamping fixture which is indexed hydraulically in front of the three spindles. The two outside spindles rough the bore and finish the bottom face with a two-fluted cutter while the center spindle finishes the bore only with a single-point tool. A sequence of operations completes the remaining bore and finishing jobs.

7 Pilot-Protection Suit. A life-size dummy strapped in a special high-speed test sled survived a wind blast of 4000 psi—tougher than any that a jet pilot would face in an emergency. The special one-piece suit reflects the heat generated in the blast. A solid-propellant rocket developed by Astrodyne, Inc., of McGregor, Texas, propelled the sled in tests at the Air Force Missile Development Center at Holloman Air Force Base, N. Mex.

8 Coil-Handling Equipment. A floor-mounted rotating device to facilitate the handling of coils with fork and ram-type lift trucks has been developed by Yale Materials Handling Division of the Yale & Towne Manufacturing Company, in co-operation with American Can Company materials-handling engineers.

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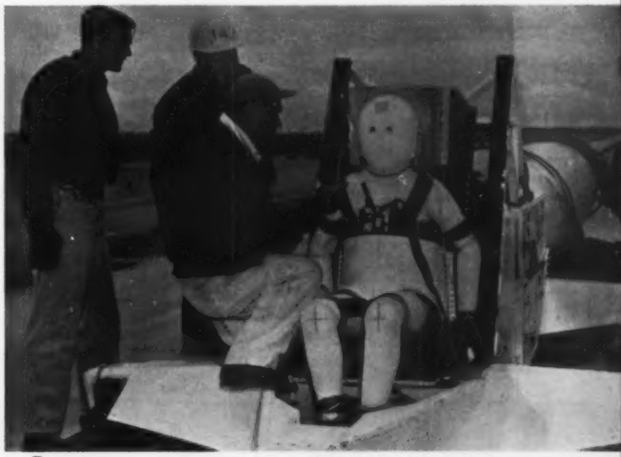

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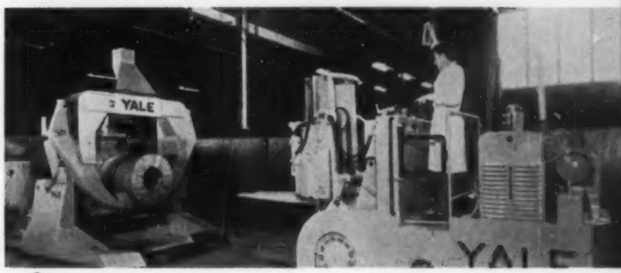

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Engineering Progress in the British Isles and Western Europe

J. FOSTER PETREE
European Correspondent

EUROPEAN SURVEY

New Mill Rolls Britain's Biggest Beams

UNIVERSAL beams up to 36 in. deep × 16$^1/_2$-in. flange width can be rolled in the new mill recently brought into full production by Dorman, Long and Company at Lackenby, near Middlesbrough, England. This is a big advance in British steel-rolling, as hitherto beams of this size and of the broad-flange type have had to be obtained either from mills on the Continent of Europe or from America. The Lackenby mill is one of the most widely adaptable in existence, as it can produce beams in a range which extends from the size mentioned, weighing 260 lb per ft, down to 6 in. × 6 in. and 20 lb per ft, and in addition can be used to produce any of the present range of British Standard sections; but the universal broad-flanged type offers such advantages to the structural engineer in its improved strength/weight ratio, and in the closeness of the steps in strength modulus, that it is expected that the mill will be employed in rolling only angles, channels, and piling sections in addition to the universal beams for which it has been primarily designed. Capacity is 8000–10,000 tons per week.

The method of rolling universal beams is still basically the same as in the first mill of this type, which was installed in Luxembourg in 1902. Four rolls are employed, two vertical and two horizontal, with their axes all in the same vertical plane, so that pressure is applied to all faces of the beam simultaneously. A separate stand close to the main stand, and having two rolls only, squares the edges of the flanges and controls their width. By using four rolls together, a uniform elongation is applied to all parts of the section at the same time and it is possible to roll much wider flanges than is practicable with the British Standard sections in which there are two rolls only to force the steel downward against the sides of deep grooves in the rolls. Moreover, the universal beam can be rolled with only a very slight taper on the flanges—2 deg 52 min instead of the 8 deg of the British Standard section.

The mill building has an area of 26 acres under one roof and is nearly 3000 ft long, of which the main mill bay, containing all the stands and their rolling tables, is 2440 ft in length, with a crane span of 88 ft 6 in. Leveling of the site began in April, 1954, and the first steel was rolled in January, 1958, though it was some months later before the mill came into full production. In an adjacent bay a new rod mill is under construction, to supply rod for the company's wire mills, which have recently received the contract for the wire for the suspension bridge across the Firth of Forth, in Scotland.

The steel for the beam mill comes from Dorman, Long and Company's neighboring Lackenby steelworks, in ingots ranging in weight from 4 tons to 20 tons, and is delivered in the molds. For stripping the molds from the ingots there are two cranes, one having a lifting capacity of 40 tons and a stripping capacity of 400 tons, and the other, for the smaller ingots, of 20 tons and 120 tons, respectively; 4800 tons of molds are stocked, in five sizes.

Adjoining the stripping bay are the soaking pits, 12 in number, normally fired with blast-furnace gas, brought two miles through a main 5-ft 6-in. diam from the company's Cleveland Works. Coke-oven gas can be used to boost the temperature if required. Each pit is provided with Escher recuperators, one for gas and one for air, giving a preheat of 1000 to 1200 C. The lids are operated by push-button control from the soaking-pit crane, the combustion air and gas being automatically shut off

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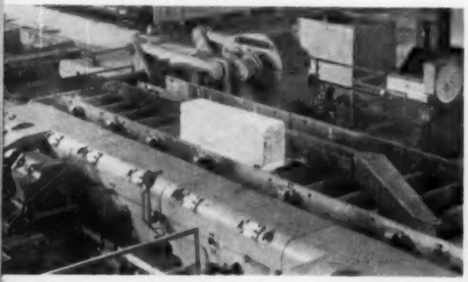
Correspondence with Mr. Petree should be addressed to 36 Mayfield Road, Sutton, Surrey, England.

Approach table to blooming mill with soaking pits *in background*



Universal roughing mill rolling large beam. Outgoing side is shown here.

Universal roughing mill with edging stand in front of main stand

while the lid is open. The crane driver controls the whole operation of taking an ingot from the pit, placing it in the tilting chair which transfers it to the blooming mill, and starting the receiving table which passes it over the weighing machine. When it leaves the weighing machine the mill operator takes charge of it.

The rolls of the blooming mill are 52-in. diam and 112 in. long on the barrel. The mill produces shaped blooms for the universal beam sections and rectangular blooms for the British Standard sections, and has been designed with a high lift so that, if required, it can roll slabs for the company's plate mills. Slabs up to 50 in. wide can be rolled and sheared. The drive is by two electric motors, each of 4000 hp, with a speed range from 40 to 90 rpm. The rolls weigh about 30 tons each and are carried in resin-bonded fabric bearings, lubricated by water and grease. When the mill stops, a water-repellent oil is supplied automatically to each roll neck, to prevent rusting. The main housing screws, 18-in. diam, are driven by 150/300-hp motors with Ward-Leonard control, and have a screwing speed of 150 to 300 in. per min. The mill driving spindles are 23-in. diam and 32 ft 9 in. long. To insure continuous lubrication, the universal joint at the motor end of the spindle is totally enclosed. The joint at the mill end is lubricated by grease, fed by pump along the spindle directly to the slipper faces.

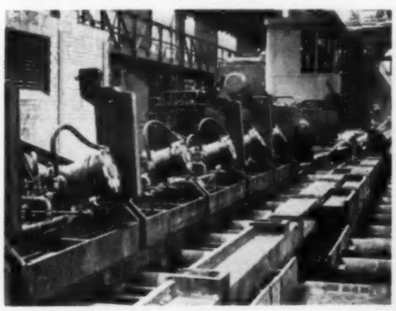
The whole of the manipulator traversing and tilting gear is arranged on the motor side of the roller table, leaving the other side completely clear for roll changing. The 14 rollers in the table are of forged steel, 20-in. diam and 10 ft 6 in. long. The four rollers on each side of the mill are driven independently of the others. The main table frames are of cast steel, with the seatings for the roller bearings of the table rollers bored from the solid. For rapid changing of the mill rolls, a duplex roll-changing rig, carrying two complete assemblies of rolls and chocks, is provided alongside the mill, the whole operation of roll changing being controlled by one man from an adjoining desk. An open-sided up-cutting hydraulic bloom and slab shear, of 1350-tons capacity, 127 ft from the mill center, can cut slabs up to 10 in. thick and 50 in. wide, or equivalent sectional areas up to $19\frac{1}{2}$ in. thick, and can make four cuts at full stroke in $1\frac{1}{2}$ min, repeating after a lapse of the same duration.

Shaped blooms for the largest beams, which do not require reheating, go straight from the shear to the universal roughing mill and thence to the finishing mill, which is practically a duplicate of it. Those which do need reheating are skidded sideways to a bloom bank and so to a reheating furnace of 80-tons-per-hr capacity, which takes blooms up to 28 ft long. Rectangular blooms may also go direct from the shear to a breakdown mill to be reduced- The same mill is designed to be used also to reduce blooms for a four-stand billet mill, which will supply billets to the rod mill.

The main rolls of the roughing and finishing mills are 53-in. diam. The drive is by a single motor of 8000 hp with a speed range from 65 to 165 rpm and a maximum operating torque at 65 rpm of 1,615,000 lb/ft. The edging stand has two rolls of 43-in. diam, each driven by a 1350-hp motor. Mechanically adjusted side guides are provided, as the very slight taper on the flanges is not sufficient to insure good guiding of the beam into the rolls, and these are synchronized electrically with the motors driving the roll screws. The schedule of steps in the reduction can be preset and, while the mill is working, another schedule can be set up for the next section to be rolled. When roll changing is required, the complete main and edging stands are lifted out by overhead cranes (one of 275 tons and the other of 160 tons capacity); for this purpose they have heavy built-in shackles to engage the ram's-horn hook of the crane, the whole operation being controlled by the crane driver from his cab. Spare stands, set up in readiness, are then lifted into place. Seven dummy mill beds are provided for their preparation.

On leaving the finishing stand the rolled bar can be guided by hydraulically operated sweeps into either of two roller tables leading to two hot saws of the horizontal sliding-frame type, with a stroke of 5 ft 10 in. The saws are 72-in. diam and driven by 500-hp motors. They have a peripheral speed of 21,200 fpm. The measuring gear will cut bars to any length desired by the customer, as fast as they come from the mill; in other words, the measuring head must be set in position while the previous length is being cut. On the runout side of each saw is a sliding carriage having six air-operated hatchet stoppers spaced at 10-ft $1\frac{5}{8}$-in. centers; that is, a nominal 10 ft plus an allowance for the contraction of the cut-hot bar. The carriage can be moved hydraulically 10 ft, so that any length can be cut from 10 ft to 70 ft. Carriage movement and stopper selection are controlled by push buttons. The contraction allowance can be varied if bars come through at a higher or lower temperature than the expected figure; this is effected by a pilot motor which increases or decreases the travel of the measuring carriage by a known amount. While a bar is being cut the stopper is lifted, freeing the carriage and cancelling the previous selection. The carriage then moves to its next preset position and the appropriate stopper drops into its socket while a new bar travels forward to be cut.

Hot-saw measuring carriage will cut bars to any length desired



Primary cooling bank. Operator is turning up a beam.

Piling crane using four magnets lifts beam to build a pile

Substance in Brief of Papers Presented at ASME Meetings

M. ZANFARDINO
Staff Editor

ASME TECHNICAL DIGEST

Production Engineering

Development and Application of Trepanning . . . . 58—A-183

By A. C. Heidenreich, The Warner and Swasey Company, Cleveland, Ohio. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

Trepanning is a method of producing a hole by cutting out a narrow ring of material in the workpiece, leaving a center core instead of moving all the material in chips such as in spade drilling. Trepanning was developed in Germany during World War II in the manufacturing of gun barrels. Immediately after the war, this method was brought to the United States and used similarly during the Korean War.

Trepanning not only offers a faster means of producing a hole, but the resultant hole is more accurate, more concentric, and has a better finish.

The saving in time is tremendous because of the higher cutting speeds and feeds that can be used with carbide tools compared to those that can be used with high-speed steel. The long life of carbide also insures minimum wear which enables the maintenance of a tolerance of plus or minus 0.003 in. on the diameter of the hole. The finish in the hole is also improved owing to the burnishing action of the two wear pads on the trepan head.

There are two types of trepanning. One is where the trepan bar is piloted in a bushing located in a gland with a revolving seal that is resting against the end of the workpiece. The coolant comes into the gland over the outside of the trepan head and rushes out through the center of the bar carrying off the chips. The second type is where the bar is piloted only by a bushing near the end of the workpiece and the coolant comes in through the center of the bar and pushes the chips over the outside of the trepan head and out of the workpiece.

In testing the self-centering trepan head, many problems such as machine rigidity, alignment, coolant volume and pressure, good control of spindle speed and cutter feed had to be dealt with. Some of these problems and efforts spent to correct them are discussed in this paper.

The Efficient Use of Welded Steel in Machine Design . . . . 58—A-223

By Omer Blodgett, The Lincoln Electric Company, Cleveland, Ohio. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

A machine designer chooses steel weldments over iron castings for a variety of reasons—appearance, flexibility of design, improved machine operation—but the most important generally is lower costs. The designer who efficiently uses the excellent properties of steel and the advantages of arc welding as a method of manufacturing substantially reduces the cost of his end product. The paper offers suggestions and guides for the efficient use of welded steel in machine design.

In designing steel weldments, where a designer places steel in the part affects significantly the amount of steel that must be used, and, consequently, manufacturing costs. Using the proper sections and putting them in the right place to carry a given type and amount of loading substantially reduces costs.

Two of the most common types of loads encountered in designs, either structural or machine, are bending and torsion.

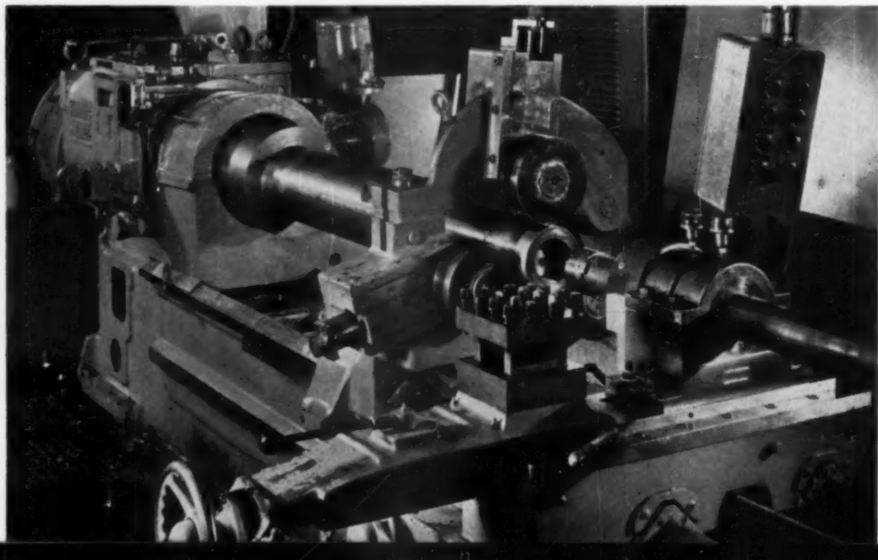
This paper presents basic rules for each type of loading and includes check lists for design, layout, joint design, and weld design.

Study of Machinability of Metals . . . . 58—A-161

By H. Takeyama and E. Usui, Government Mechanical Laboratory, Tokyo, Japan. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.*; available to Oct. 1, 1959).

Why is machinability different among various metals even though the machining conditions are entirely equal? For example, when copper is machined, the chips are very thick with a very small shear angle, whereas when an alloy steel is machined, the behavior is opposite.

The object of this experiment is to investigate the reason for this. However,



Trepan lathe, showing the part completely bored and ready to be unloaded (58—A-183)

the term "machinability" has various aspects, that is, chip formation, cutting force, tool life, surface finish, and so on, which are associated with each other to some extent. In this paper the definition of machinability is confined to that in terms of chip formation, which is one of the fundamental aspects, in order to find some sensible relationship between machinability and the physical properties of a metal.

In an earlier paper by the authors, machinability in terms of chip formation was demonstrated to be controlled by the tool-chip contact area, and the equation $\cot \phi = \cot \phi_0 + KA/(A' \cos \alpha)$ was introduced, where ϕ is the shear angle, ϕ_0 the shear angle when the tool-chip contact area is assumed to be zero, A the tool-chip contact area, A' the area of cut, α the rake angle, and K a constant of proportionality. Therefore the analysis of machinability thus defined must be possible by means of the theory of tool-chip contact area previously derived by the authors.

In this experiment, the machinability data, when various types of metals were machined under definite conditions, were analyzed and compared with the material testing data for these metals. As a result, it was found that the slope of the shearing test curve near the fracture point is closely associated with the behavior of the metallic fracture ahead of the tool face during machining, and, furthermore, with the tool-chip contact area or the machinability in terms of chip formation.

Kennametal Dynamometer Utilizes the High YME of Carbide for Rigidity in Construction......58—A-87

By J. M. Galimberti, Assoc. Mem. ASME, Kennametal Inc., Latrobe, Pa. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

A newly developed two-component tool-post dynamometer designed to take advantage of the high Young's Modulus of Elasticity provided by tungsten carbide is described. The fabricated dynamometer of cantilever design used four tungsten-carbide beams for maximum rigidity and stiffness in construction. With this high rigidity and stiffness, the dynamometer still possesses adequate sensitivity, is free of hysteresis, and offers negligible cross sensitivity. Construction and calibration of the dynamometer, test equipment, procedures, results, and evaluations are outlined. Additional representative data are given to show how this application of carbide, the related equipment, and the techniques used contribute to the evaluation of tool composition and study of metal-cutting principles.

With such an instrument it is possible to determine and study such factors as variation in cutting force with change in speed, feed, depth of cut, tool geometry, work material, cutting fluid, tool composition, and tool life. Other factors such as net power absorbed at the tool in cutting, cutting energy required in terms of horsepower per cubic inch per minute, and the over-all efficiency of a lathe based on electrical motor input, or mechanical efficiency based on motor output, may also be determined and studied. The data obtained from the dynamometer can be analyzed in conjunction with data obtained from other methods of evaluation and other instruments. The net analysis can then be used as a guide to form the basis for decisions regarding the proper design and application of cutting tools, and tool-material evaluation for attaining optimum production efficiency in the shop.

Some Observations on the Shearing Process in Metal Cutting............................58—A-139

By S. Kobayashi, Doshisha University, Kyoto, Japan; and E. G. Thomsen, Mem. ASME, University of California, Berkeley, Calif. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

It was found that shearing forces on the shear plane were linear functions of the area on which they acted. This was observed for all materials investigated; for SAE 1112 steel, 2024-T4 and 6061-T6 aluminum alloys, and alpha-brass, and also is in agreement with data taken from the literature. Furthermore, all data examined showed that the straight line of shear force F_s versus area A_s intercepted the ordinate at a positive force value. This was interpreted to mean that the intercept part of the shearing force was used up in overcoming workpiece deformation or friction at the flank of the tool and was not available for chip deformation. Accepting this concept, it can then be shown that the average shearing stress on the shear plane for SAE 1112 is constant and is independent of normal stress, cutting speed, or strain rate, extent of deformation or finite strain, and extent of prior deformation. The shearing stresses for the other materials tested or examined were also constant for the limited range of variables available.

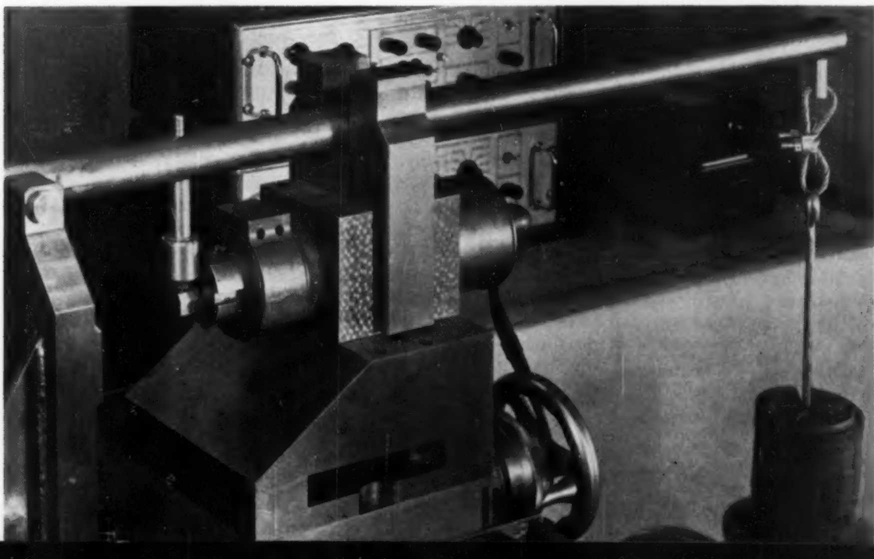
In contrast, in the shearing stress, the normal stress on the shear plane was not constant and appears to be a yet unknown function of the mechanism of friction on the tool face.

The shearing stresses calculated from the metal-cutting data showed good correlation with flow stresses at the same finite strains which were obtained from static compression tests. The reason for the uniqueness of the finite strains at which correlation is achieved is not as yet clear.

A Three-Dimensional, Tool-Life Equation—Machining Economics..............................58—A-123

By B. N. Colding, The Cincinnati Milling Machine Company, Cincinnati, Ohio. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

In Part 1 of this paper, two tool-life equations are derived, one limited equation and one general tool-life equation, between the variables cutting speed, chip



Calibration of dynamometer using system of dead weights and lever-arm. Tangential cutting force shown being calibrated. (58—A-87)

equivalent, and tool life. The chip equivalent, introduced by Woxén, is a well-defined function of feed, depth of cut, nose radius, and side-cutting-edge angle. The limited equation takes into account the variation of Taylor's exponent n with the value of the chip equivalent, but the equation is only valid within certain limits of cutting speed and chip equivalent. A general equation is then derived on the basis of the limited equation.

In Part 2 an expression called the productivity is derived. This relationship is valid for either maximum production or minimum cost and, combined with the general, hyperbolic, tool-life equation, it is used to investigate the optimum combination of tool-life, cutting speed, and chip equivalent.

Theory and Experiment of Press Forging Axisymmetric Parts of Aluminum and Lead . . . 58—A-154

S. Kobayashi, Doshisha University, Kyoto, Japan; R. Herzog, J. T. Lapsley, Jr., and E. G. Thomsen, Mem. ASME, University of California, Berkeley, Calif. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

The mechanics of finishing in a press-forging operation were analyzed. It was concluded that the metal in the die, as well as that contained in the flash, could be treated as a fictitious disk which is subjected to compression between flat surfaces under variable surface friction. Comparison of experimental average pressures with those predicted by the foregoing simplified theory showed good agreement.

The Effect of Process Variables on Extrusion Pressures of Lead . . . . 58—A-109

By J. Frisch, Assoc. Mem. ASME, and E. G. Thomsen, Mem. ASME, University of California, Berkeley, Calif. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

Billets of commercially pure lead, 2 in. diam × 3 in. long, were extruded at room temperature through five different die contours at ram speeds up to 50 ipm. It was found that, for the direct and indirect extrusions, with good lubrication (white lead in oil) and with good cylinder-wall finish, the extrusion pressure-displacement diagrams were essentially the same. The concentric and eccentric single-bar and multibar extrusions at constant extrusion ratio required approximately the same pressures when extruded at identical speeds. The extrusion pressures over the wide range of speeds investigated showed approximate linearity when plotted on log-log co-ordinates.

Lubrication

Surface Finish and Clearance Effects of Journal-Bearing Load Capacity and Friction . . . . 58—A-134

By F. W. Ocvirk, Mem. ASME, and G. B. DuBois, Cornell University, Ithaca, N. Y. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

A criterion for determining the limit of hydrodynamic lubrication based on the magnitude of the roughness of the surface finish of journal and bearing is proposed in this paper. Perfect alignment of the journal and bearing is assumed and only surface roughness is considered. Analytically determined design curves are presented giving the load capacity of a bearing corresponding with a minimum film thickness limited by the irregularities of a given surface finish. Experimental load-capacity data are compared with analytically determined data.

In the analytical curves presented, the form of plotting has been chosen to show directly the influence of clearance ratio and minimum film thickness on load capacity. The method of plotting also makes it possible to show the influence of clearance and film thickness on journal and bearing friction, showing the conditions for minimum friction. Although eccentricity ratio is the fundamental variable in the hydrodynamic equations, the equations are rearranged to give a form of plotting which emphasizes clearance and minimum film thickness rather than eccentricity ratio. In heavily loaded bearings, the changes in eccentricity ratio are relatively small for large changes in load, whereas the changes in minimum film thickness are relatively greater.

The Measurement of Oil-Film Thickness in Gear Teeth . . . . . 58—A-142

By I. O. MacConockie, Assoc. Mem. ASME, and A. Cameron, Imperial College, London, England. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

One of the major troubles encountered in any work on gears is the difficulty in getting near the line of contact and the consequent problem of making any measurements there. Many investigators have tried to use electrical resistance as a means of deciding on the type of lubrication found in gears, but it is generally recognized that it is impossible to obtain any quantitative data from these measurements.

The voltage drop across thin oil films when a constant current of 1 amp is passed, i.e., the discharge voltage, is used to measure the oil-film thickness between loaded gear teeth while running. It is found that the thickness at the pitch line is between 1 and 4×10^{-4} in., which varies slightly with the viscosity and rather more strongly with load. The thickness at the tips and roots is quite dependent on the tip relief. The conditions here may explain the difference between disk and gear tests. These experimental values are compared with theoretical work and are shown to be of the same order of magnitude.

On the Effect of Lubricant in the Theory of Hydrodynamic Lubrication . . . . 58—A-195

By A. A. Milne, Mechanical Engineering Research Laboratory, Glasgow, Scotland. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

A theoretical study is made of the corrections required to the basic lubrication equations to allow for small effects of lubricant inertia in the laminar regime. The problem is approached by first determining the stream function for a wedge-shaped oil film with purely viscous flow and then obtaining the first-order correction for inertia. For the particular case when the convergence of the film is small, the resulting expressions for pressure gradient and tangential drag are compared with those obtained by other methods. Close agreement is found with Kahlert's equations, but the present expressions are more general in form. It would appear that, in general, the effect of lubricant inertia is to cause a slight increase in the load capacity of a bearing.

The Influence of the Molecular Mean Free Path on the Performance of Hydrodynamic Gas Lubricated Bearings . . . . 58—Lub-7

By Albert Burgdorfer, The Franklin Institute Laboratories, Philadelphia, Pa. 1958 ASLE-ASME Lubrication Conference paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

A modified Reynolds equation is derived for gas-lubricated hydrodynamic bearings operating under "slip-flow" conditions. Closed analytical solutions are given for a Rayleigh type step-bearing and an inclined plane slider bearing for the case of two-dimensional flow.

The influence of the molecular mean free path on the performance of bearings of arbitrary form is obtained by means of a small parameter, perturbation technique.

Aviation

The Rolls-Royce Dart—Past, Present, and Future........58—A-255

By Bernard Lang, Rolls-Royce of Canada, Ltd., Montreal, Canada. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

The Rolls-Royce Dart is a propeller turbine engine in which the propeller and direct-entry two-stage centrifugal compressor are driven by a two-stage axial-flow shrouded turbine, the compressor being coupled to the double turbine assembly directly and to the propeller through a compound reduction gear. Situated between the compressor and turbine are the seven interconnected straight-flow combustion chambers providing the motive force for driving the turbine which in turn drives the compressor and propeller.

The operating cycle is a continuous process of taking in air through the annular air intake surrounding the reduction gear, compressing it in the two-stage compressor, adding fuel in the form of a spray through atomizing burners and igniting the resulting mixture in the combustion chambers, and allowing this high-energy gas to expand in the turbine thereby causing its rotation. Most of this energy is converted into shaft horsepower to drive the compressor and propeller, the residual energy being passed through an exhaust system to atmosphere, thereby producing a small amount of jet thrust. A small percentage of the engine power is used to drive the engine ancillary units.

Engine power is dependent upon the mass flow and temperature of the high-energy gas stream entering the turbine. The mass flow is controlled by varying the engine speed, through the variable-pitch propeller of the constant-speed type, while the temperature is controlled by throttling the fuel flow.

The history of the Dart, dating back to 1943, is given in some detail in this paper. The engine's applications, its serviceability, and performance development are also treated.

Design Aspects and Flight Testing the Vertol 76 Tilt-Wing VTOL/STOL Research Aircraft......58—A-278

By P. J. Dancik and W. B. Peck, Vertol Aircraft Corporation, Morton, Pa. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

The Vertol 76 is a two-place research aircraft developed to explore the tilt-wing VTOL principle. In the design and construction of this experimental craft standard and existing components were used wherever possible. Development time, therefore, was concentrated on main points such as the control system, the tilt-wing system, and aspects of dynamics and aerodynamics.

Vertol 76 tilt-wing aircraft during conversion (58—A-278)

A Lycoming T-53 free turbine engine transmits power by mechanical shafting to two three-bladed rotor propellers and two four-bladed tail control fans. The two rotor propellers are interconnected mechanically and, in the event of power failure, override the engine through a sprag clutch installed in the upper central transmission. A speed selector and power lever are the one and only engine control necessary. Rotor speed is manually selected and maintained by a governor in the engine.

A ten-hour tie-down test, tail-fan tests, taxi tests, hover flight, and a 50-hour tie-down test are described. Conversion tests are also reported.

Tests to date have shown the feasibility of the tilt-wing principle. The present research aircraft has demonstrated the ease with which conversions can be accomplished and the versatility of the Vertol 76 type craft in both VTOL and STOL flights.

Extrapolating Sink-Speed Requirements for Carrier-Based Aircraft.. ....58—A-242

By J. de S. Coutinho, Mem. ASME, and Nathan Lichter, Grumman Aircraft Engineering Corporation, Bethpage, L. I., N. Y. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

The sink speed of a carrier-based aircraft beyond the range of observation is evaluated by the Monte Carlo method. The sink speed is established as a function of the engaging speed, the flight-path angle, and the deck-pitch angle. The distributions of these three independent variables are developed. A set of values consisting of a random value of each of the independent variables is selected and the corresponding value of sink speed is computed. The process is repeated on an electronic computing machine as often as necessary to establish the distribution of the sink speed with sufficient accuracy to plot the extremity of the sink-speed distribution curve through the range of engaging speeds for which the data are required.

Investigation of Steady-State Anisoelastic Torques in Gimbal Systems Under Vibration.......58—A-250

By R. J. Vaccaro and D. D. Martin, Sperry Gyroscope Company, Great Neck, N. Y. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

The vibration of a gimbal system which is not isoelastic along any two co-ordinate axes will result in steady-state torque being developed about the third axis. This phenomenon was studied for systems having both linear and nonlinear response with viscous damping, and torque equations were derived. An experimental program was conducted on a gimbal system having linear response, and steady-state torque values were measured. Correlation between theory and experiment was good. Examination of the linear torque equation revealed that, for small values of damping, minimum torque is obtained with an isoelastic system. However, small deviations from the isoelastic point, defined by the system damping, will result in maximum steady-state torque, thereby placing severe limitations on the practical consideration of this region.

Nondimensional Performance Characteristics of a Family of Gyro-Wheel-Drive Hysteresis Motors.... ....58—A-251

By W. G. Denhard, Mem. ASME, and D. C. Whipple, Massachusetts Institute of Technology, Cambridge, Mass. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

In the design of a gyroscopic instrument, careful attention must be paid to the relationship between torque capacity and efficiency, to the weight of the gyro-wheel-drive motor, and to the range of torque loads that the motor must drive.

In correlating drive-motor design with variations in load, it is of great benefit to know what changes in load may occur from such variables as the temperature of the gyro-wheel assembly or the tolerance in the basic wheel bearing load. Accordingly, this paper presents certain useful mechanical and electrical characteristics of a family of hysteresis motors developed at the Instrumentation Laboratory, M.I.T., for use as gyro-wheel-drive motors.

The information in this paper is based on test data obtained at the Instrumentation Laboratory, M.I.T. This information is presented as a series of nondimensional curves together with a brief discussion of each curve. The curves are all presented in nondimensional form so that they will not be limited by applying only to a specific member of this family of motors as would be the case if actual values of the variables involved were shown.

The mechanical characteristics of this family of motors show the interdependence between torque load (combined friction and windage torque), bearing preload, temperature of the gyro-wheel assembly, and wheel speed. Since the motor is the main independent source of heat in the gyro, the temperature of the wheel assembly and the temperature gradients existing throughout the gyro are largely determined by the total amount of heat dissipated in the motor. The amount of heat generated, and therefore dissipated, is in turn determined by the combined friction and windage torque load on the motor and the electrical efficiency of the motor. Therefore, various electrical performance curves are presented that show the relationship between gyro-motor efficiency and load torque at various applied voltages, and also between gyro-motor maximum obtainable efficiency and angular momentum.

In addition, since the load on the power supply is also an important design consideration, other curves show the variation of gyro-motor power input with applied voltage and wheel speed for given torque-load conditions.

Hydraulics

Deriaz Type Reversible Pump-Turbine Installation at Sir Adam Beck-Niagara Forebay Pumped Storage Project.........58—A-77

By A. E. Aeberli, Mem. ASME, The Hydro-Electric Power Commission of Ontario, Toronto, Ontario, Canada. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. of Basic Engng.;* available to Oct. 1, 1959).

Installations constructed by Ontario Hydro in the vicinity of Queenston Village on the Niagara River comprise two major stations known, respectively, as Sir Adam Beck-Niagara G.S. No. 1 (Queenston powerhouse completed in 1930) and Sir Adam Beck-Niagara G.S. No. 2 (completed in 1958) together with the forebay storage pumping-generating station (completed in 1958).

Water is conveyed from intake structures, located in the Niagara River upstream from the Falls, to the headworks of both power stations by two large hydraulic tunnel conduits terminating in a large open-cut canal and also from the original full length open-cut Queenston canal. The forebay storage reservoir is located a short distance upstream from these two stations. The pumping-generating station pumps to store water in the reservoir at an elevation higher than the forebay and returns it to the main forebay as required to augment the supply diverted from the Niagara River during daytime high-load periods.

The artificial forebay reservoir provides 15,500 acre-feet of storage capacity with a variation in pond level of about 25 ft. The tail water of the reversible pump-turbine units is subject to variations of as much as 13 ft. This is caused by changing hydraulic gradients in the feeder tunnels and canals, and reflects the permissible daily and seasonal treaty diversions of water from the upper Niagara River for power purposes.

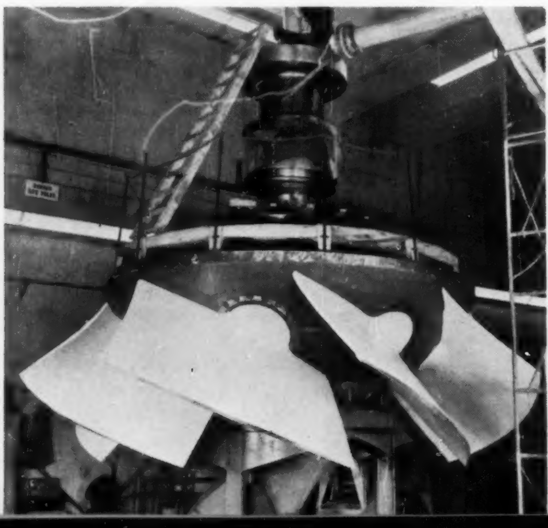
The civil, hydraulic, planning, and construction features of the forebay reservoir storage scheme and the two main power stations, and the economies thereof, are well described in recent technical papers published elsewhere.

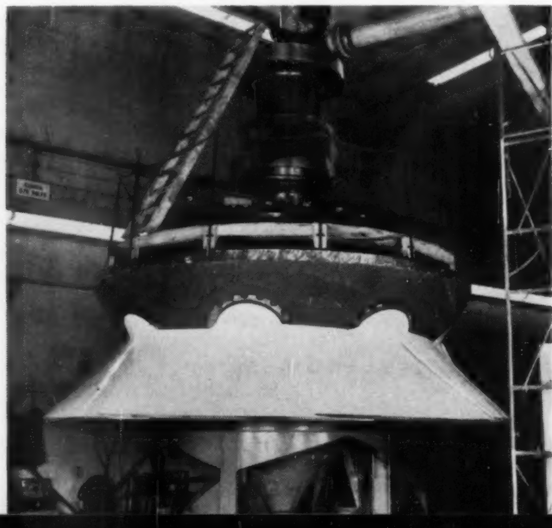
Therefore this paper will deal particularly with certain mechanical and hydraulic features of the reversible pump-turbine equipment installed in the pumped-storage station.

This paper describes the new adjustable blade, single-speed, vertical, single-runner reversible pump-turbine units recently developed and placed into service at Ontario Hydro's forebay storage pumping-generating station at the S.A.B. Power Project on the Niagara River.

The units operate under unusual variations in head. In the pumping sequence the limits are 59 and 90 ft and in the turbine cycle from 45 to 85 ft. Tail-water depression is not required on start-up. Change-over from turbine to pumping sequence is accomplished in a matter of minutes and occurs several times each day. Data are given on the performance requirements for capacity and efficiency versus hydraulic operating conditions of head, tail water, and forebay reservoir levels. Information in the paper includes unusual features of mechanical design.

Deriaz type reversible pump turbine in use at Sir Adam Beck-Niagara Forebay Pumped Storage Project, with blades open, *left,* and closed, *right* (58—A-77)





The Unsteady Wake Interaction in Turbomachinery and Its Effect on Cavitation............58—A-114

By Hsuan Yeh, Mem. ASME, University of Pennsylvania, Philadelphia, Pa.; and J. J. Eisenhuth, Pennsylvania State University, University Park, Pa. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

In an axial-flow turbomachine, the relative motion between stationary and rotating blade rows presents a nonsteady flow problem. As a consequence, each blade experiences pressure and velocity perturbations which fluctuate with time. Kemp and Sears investigated the over-all effect of the fluctuating lift and induced drag of the blades, whereas Meyer undertook a detailed study of the pressure and velocity perturbations themselves. Although such perturbations are undoubtedly significant in the (refined) flow analysis of all turbomachines, the pressure perturbation is especially important in liquid-handling turbomachines owing to the phenomenon of cavitation. Recent interest in turbopumps for liquid-fueled rockets strongly indicates a need for renewed research of this phenomenon. In addition to turbomachines, the application to propellers is obvious.

This paper attempts (*a*) to predict theoretically the influence on the nonsteady pressure perturbations on a blade row due to periodic wakes shed from an upstream blade row and (*b*) to compare such theoretical predictions with a series of carefully conducted cavitation experiments at the Garfield Thomas Water Tunnel of the Ordnance Research Laboratory. The results indicate that the experimental values of pressure perturbations are somewhat lower than theoretically predicted values. The general trend, e.g., the influence of wake width and wake spacing, is in substantial agreement between theory and experiments.

Cavitation and NPSH Requirements of Various Liquids......58—A-82

By Victor Salemann, Assoc. Mem. ASME, Worthington Corporation, Harrison, N. J. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

Net positive suction head (NPSH) is defined as the difference between the absolute suction head and vapor pressure at suction temperature. The minimum required NPSH is usually found by test, in which total head and efficiency are measured as a function of a cavitation coefficient. When converted to or tested at constant speed, a deviation from the initially constant value results when cavitation begins. Noise and vibration usually accompany cavitation and are also used as a means of detection. Generally, a small percentage drop in head is used to define the minimum required NPSH.

It has been known for some time that pumps operating on hydrocarbons can perform satisfactorily when supplied with less NPSH than the minimum required for cold water. Head, capacity, and efficiency experience little change and apparently no cavitation erosion takes place.

Test results on the net positive suction head, NPSH, requirements for centrifugal pumps handling water up to 420 F, some hydrocarbons, and Freon-11 are presented. Satisfactory pump performance was observed with net positive suction heads less than those required by the pump on cold water. A direct measurement of NPSH was attempted and is reported. The cavitation process is discussed and a correlation and method of prediction for all liquids are proposed.

Radial Equilibrium in Supersonic Compressors..........58—A-110

By A. G. Hammitt, Assoc. Mem. ASME, and S. M. Bogdanoff, Princeton University, Princeton, N. J. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

In the study of axial-flow rotating machinery, it is convenient to examine the performance of a two-dimensional cascade as a first step in analyzing the more complicated three-dimensional problem. In the simplest case, the two-dimensional results can be wrapped around a cylinder, reducing the three-dimensional flow to two-dimensional flows on concentric coaxial cylinders. The actual flow through the transformed two-dimensional cascade will no longer be on a plane but on the surface of the cylinder. A radial pressure gradient must exist to overcome the resulting centrifugal force produced by the circumferential motion not experienced in the two-dimensional study. If this radial pressure gradient is not correct, then the flow will depart from the design path on the cylinder and the strictly two-dimensional results can no longer be applied directly to the three-dimensional flow.

The radial equilibrium conditions in subsoni ccompressors have received considerable attention. Solutions for the restricted case of flow on coaxial concentric cylinders have been available for many years, and the transformation of two-dimensional results for cases where significant radial velocities have been experienced also have been obtained. The general procedure has been to satisfy the radial-equilibrium conditions at a station just ahead of and just behind the blade passage. Since the pressures vary quite smoothly from entrance to exit conditions, the detailed flow within the blade passage has not been an important consideration. However, the application of radial equilibrium conditions to supersonic flows has brought several new problems into the investigation. The general procedure was again to apply radial equibrium ahead of and behind the supersonic compressor-blade passage. However, in the case of supersonic flows where shock waves may be experienced in the blade passages, very strong pressure gradients may occur which are not directly connected with the usual application of radial equilibrium ahead and behind the blades. For such cases, the specific relations across the shock waves must be satisfied and impose restrictions in addition to the usual radial equilibrium relations. If the conditions at the shock waves are not satisfied, large deviations from the design flows will result.

The analysis presented herein is restricted to the cases where the flow approximates that on coaxial concentric cylinders. This flow is not the only type possible, but it permits the direct application of supersonic two-dimensional cascade tests and shock-wave boundary-layer studies. It permits the design of three-dimensional supersonic blade passages, including shock waves, in which complete radial equilibrium can be established throughout the entire blade passage.

The study on single shock waves presented in this paper is part of an investigation carried out for the Wright Air Development Center during the period of 1950 to 1954. The study of the two shock-wave configurations was part of an investigation carried out for the Fairchild Engine Division of the Fairchild Engine & Airplane Corporation during the period of 1954 to 1955. The authors would like to express their appreciation to both of these groups for their permission to publish these results.

Experience in the Use of the Gibson Method of Water Measurement for Efficiency Tests of Hydraulic Turbines..................58—A-78

By N. R. Gibson, Mem. ASME, Niagara Falls, N. Y. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

The purpose of this paper is to examine the records of experience, for 35 years from 1920 to 1955, in the use of the Gibson Method and Apparatus, for measuring the flow of water as applied in field

efficiency tests of turbines in hydroelectric power plants.

Diagrams, based on tables of maximum efficiencies of comparable units, from a total of 310 tests, are presented. A few unusual experiences are cited and described. A comprehensive discussion of the accuracy of the method is given, with particular reference to the critical analyses of Francis Salgat and the late Dieter Thoma and others, and to the precision which can be expected in determining the various factors required for measuring water quantities by this method.

Four appendixes give: (1) A brief description of the Gibson Method and Apparatus; (2) some slight revisions of the author's original paper published by ASME in 1923; (3) a numerical example of the delineation and computation of a differential pressure-time diagram; and (4) a partial Bibliography with notes.

The Aerodynamic Design of Two-Dimensional Turbine Cascades for Incompressible Flow With a High-Speed Computer.......58—A-141

By H. N. Cantrell, Mem. ASME, and J. E. Fowler, Mem. ASME, General Electric Company, Schenectady, N. Y. 1958 ASME, Annual Meeting paper (in type; to be published in Trans. ASME—*J. Basic Engng.;* available to Oct. 1, 1959).

The production of large steam turbines for power generation calls for the design and manufacture of machines which will meet the thermodynamic cycle and power output required by the customer. The particular cycle chosen in each case is determined on the basis of fuel costs, capital charges, available cooling-water temperature, power output desired, and other factors. As a consequence, it is found necessary by steam-turbine builders to maintain flexibility in design to meet the individual needs of different customers. Thus many individual stage designs must be made for differing pressure levels, stage loadings, diameters, and so on. Such a situation requires that a flexible design method for bucket sections be used for optimum performance.

A method for the design of large turning angle, turbine bucket cascades is given.

The method, based on conformal mapping from the logarithmic hodograph, is well adapted for use with high-speed computing machinery. Examples are given of bucket shapes designed by this method. A comparison is presented between design and test-measured pressure distribution for two cascades.

Further experimental work is being carried on with buckets designed by this method and will be reported in the future.

Machine Design

Synthesis of Path-Generating Mechanisms by Means of a Programmed Digital Computer.......58—A-85

By Ferdinand Freudenstein, Mem. ASME, Columbia University, New York, N. Y.; and G. N. Sandor, Mem. ASME, Time, Inc., Springdale Laboratories Division, Springdale, Conn. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

High-speed digital computers and the increasing complexity of mechanisms used in industry render desirable the development of design techniques for advanced forms of mechanism such as have been but little considered heretofore. Accordingly, a program of research was initiated in this department with the aim of setting up general methods of synthesis adaptable to computer programming.

A general method is presented for synthesizing plane, linked mechanisms obtainable from a single, closed kinematic chain. Using complex numbers and the matrix theory of linear systems, these methods have been applied to 4-link mechanisms for generating a path through up to five arbitrary points with prescribed corresponding crank rotations. The five-point synthesis is programmed for automatic computation on the IBM 650 digital computer, which determines all existing solutions (a maximum of 12 linkages), selects one on the basis of a quality index, and computes the generated path.

An Analysis of Critical Stresses and Mode of Failure of a Wire Rope.........................58—A-63

By W. L. Starkey, Assoc. Mem. ASME, The Ohio State University, Columbus, Ohio; and H. A. Cress, Assoc. Mem. ASME, Battelle Memorial Institute, Columbus, Ohio. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

The design of a machine part is usually based on equations which relate forces, stresses, and dimensions. Each such design equation may be associated with a discrete critical point at which the state of stress is suspected to be more severe than in the surrounding region of the part. The efficiency of the design is largely dependent upon the proper selection of critical points, the judicious application of the principles of elasticity to calculate the state of stress induced at each critical point by the forces applied to the part, and upon the correct selection of the mode of failure and failure data.

Most wire-rope design relationships of the present are based on critical-point selections and force-stress relationships which include only the effect of a direct tensile stress, and a bending stress if the rope is bent around a sheave or drum.

This paper proves by mathematical analysis that by far the greatest stress in a wire rope results from Hertz contact stresses at points of contact of wire-on-wire, and asserts that the usual mode of failure of a wire rope is fretting-fatigue initiated at such points of contact. Design relationships based on these concepts should be of great value to designers who use wire rope.

A 6×7 wire rope, with a hemp core loaded in simple tension, is used as an illustration.

The Dynamic Analysis and Design of Relatively Flexible Cam Mechanisms Having More Than One Degree of Freedom.......58—A-192

By R. C. Johnson, Assoc. Mem. ASME, Yale University, New Haven, Conn. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.* available to Oct. 1, 1959).

A simple numerical method for analyzing and designing cam systems which have more than one degree of freedom is presented in this paper. Illustrative examples are given for follower systems having two degrees of freedom. In addition to the general analysis and design methods which are derived, the examples also illustrate the importance of significant figures in the calculating procedure and the importance of the consideration of the distribution of mass throughout elastic regions. The general method of analysis and design can be extended to follower systems having more degrees of freedom than two.

Synthesis of the Four-Bar Linkage to Match Prescribed Velocity Ratios.........................58—A-115

By Philip Barkan, Mem. ASME, and E. J. Tuohy, General Electric Company, Philadelphia, Pa. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Engng. for Indus.;* available to Oct. 1, 1959).

A method is described for synthesizing a four-bar linkage in terms of its velocity ratio at two or three positions of the input crank. The two-point synthesis problem is readily solved by either graphical or longhand mathematical techniques. The method also lends itself to computer solution for the three-point synthesis problem and also for determining the best match of a desired function over a specified range of input crank motion. Where the data are incompatible with the inherent characteristics of the four-bar linkage the computations yield imaginary results.

Frictional Behavior of Metals and Plastics................58—A-243

By E. J. Weiter, Marquette University, Milwaukee, Wis.; and A. O. Schmidt, Kearney and Trecker Corporation, Milwaukee, Wis. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

There are two basic areas in which frictional characteristics of engineering materials are being investigated. One is the search for new materials which exhibit higher friction values; the other, for materials with lower friction values.

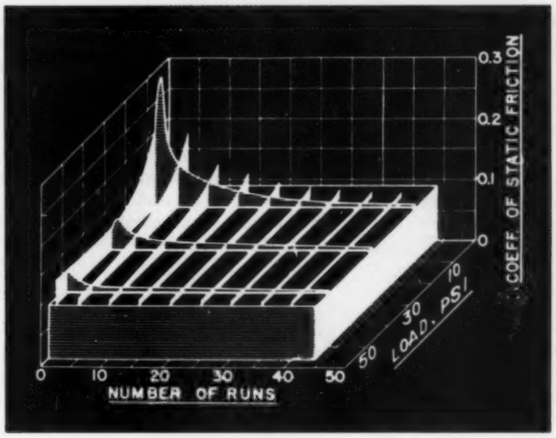
However, in either case it is essential to find the actual values of the coefficients of friction. Statements such as this found in an engineering handbook are not uncommon:

"Data on actual values of the coefficients of friction are not abundant and those available depend on the conditions of the test."

The last phrase of this statement—"depend on the conditions of the test"—points out an important consideration.

In this report the authors deviated from the traditional test apparatus, since need for this investigation was found in the problem of designing sliders for automatically controlled mechanisms of machine tools.

In order to devise a servomechanism which will operate to best advantage it is essential to know the actual values of the coefficients of static and kinetic friction.



Effect of load and initial wear on the coefficient of static friction. Plastic slider run dry on ground cast-iron slide. (58—A-243)

The flat contact area used in this work differs from the point-contact condition used extensively in other investigations. Point-contact test equipment utilizes either crossed cylinders or a hemispherical slider on a flat surface. Use of the friction values obtained from point-contact tests often leads to difficulty in design.

Preliminary tests on flat surface bearing materials indicated a considerable variation in friction values, with a degree of inconsistency that required further investigation.

The results of these tests clearly indicate that the coefficient of static friction will vary with the length of time at rest prior to breakaway. Since servo-controlled systems are at rest for variable lengths of time, the values obtained can be extremely useful.

The flat surface apparatus has provided new data on plastic bearing materials, bronze, cast iron, aluminum, and sintered metal. The actual values obtained compare with those found in operating mechanisms. In addition, the variation with time at rest and with wear were evident.

Materials Handling

The Economics of Lift-Truck Replacement.............58—A-88

By R. O. Swalm, Syracuse University, Syracuse, N. Y. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

In theory the age at which a given piece of equipment becomes economically replaceable with newer equipment of like kind can be stated quite simply. It should be kept in service for that period which minimizes its time-adjusted average annual costs. As is so often the case, this principle is easier to state than to explain—and easier to explain than to use in a practical case. This latter difficulty arises from a lack of factual data regarding the actual costs of operating a given piece of equipment (or even the average costs for each age of a given class of equipment). Because so few companies have valid data on which to base replacement studies on lift trucks, a study was designed to offer at least a broad indication, based on factual data, of the age at which a lift truck becomes economically obsolete. This study was supported by Yale and Towne, and administered by the Syracuse University Research Institute and took place during 1955 and 1956.

British Materials Handling........ ....58—A-80

By J. C. Somers, Mem. ASME, Industrial Products Engineering Company, Division of Cameron Somers Company, Inc., Long Island City, N. Y. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

Materials-handling methods in Britain are summarized in this paper. Its purpose is to: Perform the function of exchanging available ideas and information in the field of materials-handling engineering; offer a general outline of typical problems, in a limited number of cases, in Britain; and visualize some of the thinking and techniques in solution of problems encountered by our British friends in their day-to-day engineering in materials handling.

Problems, general in interest, are discussed as they relate to British methods of handling materials. They are as follows: handling of metal stock, metal scrap, transfer mechanisms, industrial safety, and handling of loose bulk materials.

Engineering for Solids Bulk Containers................58—A-89

By R. W. Wesson, Mem. ASME, Union Carbide and Carbons Chemical Company, South Charleston, W. Va. 1958 ASME Annual Meeting paper (multilithographed; available to Oct. 1, 1959).

Development of a bulk container requires a systematic approach based on sound engineering principles. Using this technique and the principles set forth in this paper, a typical sequence of steps in the development of a bulk-container system might be as follows:

1 Investigate existing methods of shipment and warehousing to determine potential savings and the desirability of having a bulk-container system.

2 Select a product model by analysis of the distribution pattern to achieve the optimum cost reduction.

3 Determine the general type and size of container desired to reduce product loss, contamination, and increase customer service.

4 Investigate the adaptability of the customers' and manufacturers' plants to handle this general type of container.

5 Select a specific container.

6 Investigate the most economical means of shipping, handling, and storing the container.

7 Try the container system by making test shipments to customers or between manufacturers' plants.

8 Set up control procedures for maintenance, procurement, and utilization.

9 Initiate the system.

The horizons for this synthesis technique are extremely broad in scope and may some day encompass a wide range of products which will provide better service and lower costs to both industry and the ultimate consumer.

Applied Mechanics

The Stresses in a Thick Cylinder Having a Square Hole Under Concentrated Loading.......58—A-22

By Masaichiro Seika, Tohoku University, Sendai, Japan. 1958 ASME Annual Meeting paper (in type; published in Trans. ASME—*J. Appl. Mech.*, December, 1958; available to Oct. 1, 1959).

A solution for the stress distribution in a thick cylinder having a square hole with rounded corners under the condition of concentrated loading is presented in this paper. The problem is investigated by the complex-variable method, associated with the name of N. I. Muskhelishvili. The unknown coefficients included in the solution are determined by the method of perturbation. Numerical examples of the solution are worked out and compared with the results available.

Transient and Residual Stresses in Heat-Treated Cylinders..58—A-21

By J. H. Weiner, Mem. ASME, Columbia University, New York, N. Y.; and J. V. Huddleston, Yale University, New Haven, Conn. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Appl. Mech.;* available to Oct. 1, 1959).

General equations for the computation of stress rates in solid and hollow cylinders subjected to transient temperature distributions are developed, based on the assumptions of an elastic, perfectly plastic material obeying the Tresca yield condition with Poisson ratio of one half. For most temperature distributions, it appears that these equations can be integrated only by numerical means. However, for one particular temperature distribution, equivalent to a phase transformation which occurs at a fixed temperature, it is found possible to integrate them analytically, and expressions for the transient and residual stresses are obtained in closed form. The latter results are compared with experiment and qualitative agreement noted.

On the Carrying Capacity of Plates of Arbitrary Shape and Variable Fixity Under a Concentrated Load.. ....58—A-20

By M. Zaid, Mem. ASME, Republic Aviation Corporation, Farmingdale, N. Y. 1958 ASME Annual Meeting paper (in type; published in Trans. ASME—*J. Appl. Mech.*, December, 1958; available to Oct. 1, 1959).

The previously known limit-load solution for a circular plate, with a centrally concentrated load, is extended to include a plate of general shape and fixity with arbitrary load location. Considering an ideally plastic material that obeys the Tresca yield criterion, this limit load is equal to 2π times the unit yield moment (M_0). The techniques of this paper can be used to establish upper and lower bounds to the limit load for plates under other loading conditions.

Laminar Flow in a Uniformly Porous Channel..........58—A-19

By F. M. White, Jr., B. F. Barfield, and M. J. Goglia, Mem. ASME, Georgia Institute of Technology, Atlanta, Ga. 1958 ASME Annual Meeting paper (in type; published in Trans. ASME—*J. Appl. Mech.*, December, 1958; available to Oct. 1, 1959).

The problem of laminar channel flow has been investigated for the case of uniform fluid suction or injection through the channel walls. The solution can be divided into three steps: (*a*) A judicious choice of stream function reduces the Navier-Stokes equations to an ordinary, fourth-order, nonlinear differential equation, which contains a free parameter **R**, the Reynolds number based upon fluid velocity through the wall. (*b*) Since general analysis of this equation is intractable, the parameter **R** is eliminated by a suitable transformation. (*c*) The transformed, nonparametric equation yields to a series solution, valid and absolutely convergent for all **R**. From this general solution, expressions are developed for velocity components, pressure distribution, and wall-friction coefficient.

A Fresh Test of the Epstein Equations for Cylinders......58—A-18

By E. H. Kennard, David Taylor Model Basin, Washington, D. C. 1958 ASME Annual Meeting paper (in type; published in Trans. ASME—*J. Appl. Mech.*, December, 1958; available to Oct. 1, 1959).

Objections that have been raised against Epstein's equations of motion for uniform cylindrical shells and the author's extensions and conclusions from them are considered. A direct proof is offered that the equations must hold, and further reasons are given for believing that they can be used in practice, at least as a basis for obtaining rationally founded approximations.

Analytical Design of Disk Cams and Three-Dimensional Cams by Independent Position Equations....... ....58—A-17

By F. H. Raven, Assoc. Mem. ASME, University of Notre Dame, Notre Dame, Ind. 1958 ASME Annual Meeting paper (in type; to be published in Trans. ASME—*J. Appl. Mech.;* available to Oct. 1, 1959).

A method for the analytical design of cams, based upon independent position equations, is presented in this paper. From these equations, one can obtain general expressions for cam parameters such as the cam contour, pressure angle, and radius of curvature. This procedure is applicable for cam systems with any type of follower motion. The mathematical directness of this method makes it possible to investigate thoroughly even the most complicated cam situations, e.g., three-dimensional cams. Also, it is shown how design charts and proce-

ASME TRANSACTIONS

The December, 1958, issue of the Transactions of the ASME—*Journal of Applied Mechanics* (available at $1 per copy to ASME member; $1.50 to nonmembers), contains the following papers:

Unsteady Laminar Boundary Layers in an Incompressible Flow, by Kwang-Tzu Yang. (58—A-3)

Thermoelectric Effects and Irreversible Thermodynamics, by G. N. Hatsopoulos and J. H. Keenan. (58—A-1)

Stresses Produced in a Half Plane by Moving Loads, by J. Cole and J. Huth. (58—APM-8)

A Refined Theory of Elastic, Orthotropic Plates, by S. J. Medwadowski. (58—APM-16)

Large Deflection of Stiffened Plates, by W. G. Soper. (58—APM-18)

Large Deflections of Annular Plates, by G. A. Wempner and R. Schmidt. (58—APM-12)

Flexure of Uniformly Pressurized Circular Shell, by J. D. Wood. (58—APM-13)

Transient and Residual Stresses in Heat-Treated Plates, by H. G. Landau and J. H. Weiner. (58—APM-14)

Pitch and Curvature Corrections for Helical Springs, by C. J. Ancker, Jr., and J. N. Goodier. (58—APM-10)

Theory of Pitch and Curvature Corrections—I (Tension), by C. J. Ancker, Jr., and J. N. Goodier. (58—APM-11)

dures may be developed to facilitate the solution of particular cam design problems.

Ductile Fracture Instability in Shear ....**58—A-12**

By F. A. McClintock, Assoc. Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1958 ASME Annual Meeting paper (in type; published in Trans. ASME—*J. Appl. Mech.*, December, 1958; available to Oct. 1, 1959).

It is postulated that fracture occurs in an elastic-plastic, nonwork-hardening material subject to pure shear when a critical shear strain is attained throughout a critical volume of material. This postulate is combined with the classical equations of plasticity to predict when cracking will initiate from a notch at nominal shear stresses below the yield stress, when the crack will become unstable on increase of stress, and when unstable cracking will occur if a notch is cut while a constant nominal stress is maintained. Tests on aluminum foil under biaxial tensile stress show results similar to those predicted by the theory.

Even with all the qualifications about comparing the shear theory with tensile data, the results are encouraging. For both theory and experiment, the cracks tend to form and to become unstable at lower stresses, the longer the crack. While there is more crack growth before instability with the longer cracks, the per cent increase in length of the cracks is less. Thus the larger of two geometrically similar specimens will crack first and the crack will become unstable after relatively less growth. In short, the larger specimen will be less ductile. For both the theory and experiments the locus of instability under increasing stress is somewhat above the locus of instability on cutting at fixed stress. And finally, the order-of-magnitude estimate from the theory is in agreement with general experience that ordinary sizes of shear cracks are not unstable in torsion below the yield strength.

Note: ASME paper No. 58—Lub-5, "The Gas-Lubricated Sector Thrust Bearing," by C. C. Mow and Edward Saibel, announced in Mechanical Engineering, December, 1958, p. 90, is not available.

Theory of Pitch and Curvature Corrections—II (Torsion), by C. J. Ancker, Jr., and J. N. Goodier. (58—APM-9)

Response of Timoshenko Beam to Random Process, by J. C. Samuels and A. C. Eringen. (58—APM-1)

Response of Complex Structures From Reed-Gage Data, by Sheldon Rubin. (58—APM-15)

Design of Accelerometers for Transient Measurements, by Sheldon Rubin. (58—APM-6)

Impact Deformation of a Cantilever Beam, by T. J. Mentel. (58—APM-4)

Plastics for Thermoelastic Investigations, by Herbert Tramposch and George Gerard. (58—APM-2)

Theory of Elastic, Plastic, and Creep Deformations, by J. F. Besseling. (58—APM-17)

Buckling of Struts of Variable Bending Rigidity, by M. M. Abbassi. (58—A-39)

Product of Inertia Coupling for a Rigid Body, by C. E. Crede. (58—A-9)

Strain-Energy Expression for Thin Shells, by J. H. Haywood and L. B. Wilson. (58—A-25)

A Test of the Epstein Equations for Cylinders, by E. H. Kennard. (58—A-18)

Buckling of Shallow Shells Under External Pressure, by E. L. Reiss. (58—A-14)

The End Problem of Cylinders, by G. Horvay and J. A. Mirabal (58—A-24)

Stresses in a Thick Cylinder Having a Square Hole, by Masaichiro Seika. (58—A-22)

The Wedge Under a Concentrated Couple, by Eli Sternberg and W. T. Koiter. (58—A-15)

Ductile Fracture Instability in Shear, by F. A. McClintock. (58—A-12)

Relief of Thermal Stresses Through Creep, by H. Poritsky and F. A. Fend. (58—A-41)

Carrying Capacity of Plates of Arbitrary Shape, by M. Zaid. (58—A-20)

Elastic, Plastic Stresses in Free Plate, by Halil Yüksel. (58—A-16)

Simple Approach to an Approximate Cascade Theory, by M. J. Schilhansl. (58—A-23)

Laminar Flow in a Porous Channel, by F. M. White, Jr., B. F. Barfield, and M. J. Goglia. (58—A-19)

Brief Notes

Improvement of the Holzer Method, by S. Mahalingam

Hydrodynamic Lubrication of a Roller Bearing, by F. W. v. Hackewitz

Dimensionless Variables in Problem of Dimensionless Analysis, by H. L. Langhaar

Variation of Tension in Stretch-Forming a Metal Strip, by D. M. Woo

Axially Symmetrical Plates of Variable Thickness, by F. Essenburg

Transient Thermal Stress by an Analogy, by S. K. Clark and R. L. Hess

Discussion

Of previously published papers by N. L. Svensson; I. Mirsky and G. Herrmann; L. E. Goodman and A. R. Robinson; G. A. G. Fazekas; W. J. Carter; F. H. Raven; W. A. Bassali and R. H. Dawoud; T-T. Loo; G. D. Galletly, R. C. Slankard, and E. Wenk, Jr.

Book Reviews

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ASME Honors Engineers

Blizard

Biographies of recipients and descriptions of Honors and Awards

THE recognition of an engineer's work by his fellow engineers is one of his greatest rewards for accomplishment. This recognition is one of the major purposes of The American Society of Mechanical Engineers.

Through the years it has become customary to confer the Society's honors at the Annual Banquet. With the tremendous growth of the engineering profession and the increase in the numbers of such honors, at the suggestion of both the Meetings Committee and the Board of Honors, the Council this year decided that the decentralization of the presentation of honors would provide the opportunity for more members to witness the presentations, and at the same time would do more honor to the recipients.

Accordingly, the presentations took place at the President's Luncheon on Monday, others at the Fuels-Power Luncheon and the Applied Mechanics Dinner on Tuesday, and still others at the Members and Students Luncheon on Thursday. The Honorary Memberships and the ASME Medal, together with the Daniel Guggenheim Medal (an international joint society award) were conferred at the Annual Banquet, Thursday.

The award of the 1958 Spirit of St. Louis Medal to George S. Schairer and the 1959 Spirit of St. Louis Junior Award to Melvin L. Baron will be deferred to the 1959 Semi-Annual Meeting of the Society in St. Louis, Mo., next June. The Blackall Machine Tool and Gage Award to Wilfred Fishwick and S. A. Tobias will be presented early in 1959.

The Society is proud of the honors it bestows and takes this opportunity to congratulate the recipients and to provide the general membership some information about the honors and the recipients.

Honorary Membership

HONORARY MEMBERSHIP IN ASME, which was the Society's initial form of award, has, throughout the years, remained its highest honor. It is conferred *for acknowledged distinctive accomplishment in engineering, or science, or industry, or research, or public service, and those allied pursuits beneficial to the engineering profession.*

John Blizard

JOHN BLIZARD, Fellow ASME, *pioneer in applying research and in deriving scientific data for the betterment of fuel-burning equipment; leader in the development of marine steam-generating equipment; true master in the art of inspiring and training young engineers; outstanding contributor to the advancement of mechanical engineering.*

During a career extending more than 50 years, John Blizard has contributed immeasurably to the advancement of engineering. Mr. Blizard earned his master's degree at the Durham College of Science in his native England in 1906.

After serving in the Canadian Department of Mines, Mr. Blizard came to the United States in 1920 and became Chief of the Fuel Section of the U. S. Bureau of Mines in Pittsburgh. As director of research for the Foster Wheeler Corporation for the past 35 years he has made many contributions to advanced practice in fuel utilization and in heat transfer. His research and analysis can be largely credited in the design of the first high-pressure marine boilers built in the 1930's and which were the predecessors of those installed in the *United States.*

Howard Coonley

HOWARD COONLEY, Affiliate ASME, *great pioneer in the development of and pro-*

Coonley

Gleason

Robinson

Armacost

Littlewood

bestowed during 1958 Annual Meeting, November 30—December 5, in New York

mulgation of industrial and engineering standards, who through the administration of standards organizations contributed incalculable benefits to the engineering profession, to industry, and to the nation.

Howard Coonley, former president of the American Standards Association, has devoted a long career to standardization activities. Born in Chicago, Ill., he was educated at Harvard University and entered the employ of Walter Baker & Company. He later served with the Coonley Manufacturing Company and then as president and chairman of the board of Walworth Company.

Mr. Coonley served as president of ASA from 1933 to 1936 and as chairman of its executive committee from 1946 to 1949. He became the first president of the International Standards Organization and served in that capacity from 1947 to 1949. He was the first chairman of the ASME Board on Codes and Standards from 1946 to 1950.

James E. Gleason

James Emmet Gleason, Member ASME, *matchless captain of industry, trusted civic leader, talented engineer, gifted inventor, and creative executive.*

James Gleason has been awarded thirty-five patents relating to gear manufacture. Two of his inventions are used to produce the automobile and truck-axle gears said to be used by the great majority of vehicles now fabricated.

Mr. Gleason was born and has lived his life in Rochester, N. Y. He studied mechanical engineering at Cornell University and then joined the Gleason Tool Company founded by his father. Mr. Gleason developed both the Two-Tool Bevel Gear Generator and the Spiral Bevel Gear Generator, forerunner of the Hypoid Gear Generators developed later by the Gleason Works.

Chairman of the board of the Gleason Works, Mr. Gleason has been a leading figure in civic affairs in Rochester for many years.

Ernest L. Robinson

Ernest Leffert Robinson, Fellow ASME, *creative engineer in the high-speed turbomachinery field; brilliant researcher; civic leader; devoted servant of his Society and his profession.*

Ernest L. Robinson was born in Canton, N. Y. He received his BA degree from St. Lawrence in 1911, and his masterate in civil engineering from Harvard in 1914. He served in the Corps of Engineers during World War I and then joined the Turbine Department of the General Electric Company. In 1921 he induced Davis and Orrok to organize the first ASME steam-table program.

During his long career with the General Electric Company he devoted himself to the design of high-speed turbine-generator and gear machinery. His technique for eliminating destructive vibrations from steam-turbine buckets was used on the first jet-airplane engines built in this country.

Mr. Robinson has been active in the Society since 1923 and is currently the ASME representative on the board of the Engineering Foundation. He is the recipient of the Melville Prize Medal in 1944 and the Society's 75th Anniversary Medal in 1955.

Medals and Awards

ASME Medal

The ASME Medal, established in 1920, is awarded for distinguished service in engineering and science. The Society established this award so that it might give recognition not only to outstanding engineering achievement, but also to achievement in science which is capable of application in engineering fields.

Wilbur Hering Armacost

Wilbur Hering Armacost was awarded the 1958 ASME Medal *for his thorough knowledge of engineering, for his application of scientific principles and results of experimental research to design problems, for his outstanding leadership in the advancement of design and materials in the field of steam-power generation, and for his administration of engineering design, and operation and research.*

A pioneer in the development of design and materials adaptable to high temperatures and pressures, Mr. Armacost has been awarded over 75 patents. As vice-president in charge of engineering at Combustion Engineering, Inc., he is credited with fostering such developments as the controlled circulation boiler and the supercritical boiler. The controlled circulation boiler, now used extensively by the power industry, incorporates many advanced design features developed by him.

Mr. Armacost began his career in 1916 after he graduated from the Armour (now Illinois) Institute of Technology with an ME degree. He became a research engineer for Armour and Company. Later he

went to the Ford Motor Company as a design engineer, a position he later held with The Superheater Company. Superheater also appointed him chief engineer. Mr. Armacost joined Combustion Engineering in 1937 as chief engineer, becoming vice-president of several of the company's divisions in 1943 and vice-president in charge of engineering in 1948.

Daniel Guggenheim Medal

The Daniel Guggenheim Medal for Aeronautics came into existence through a fund set aside in 1927 by the Daniel Guggenheim Fund for the Promotion of Aeronautics. It is awarded not more often than annually for notable achievement in the advancement of aeronautics. It is international in scope, the Board of Award being composed of members of The American Society of Mechanical Engineers, Society of Automotive Engineers, the Institute of Aeronautical Sciences, former recipients of the medal, and representatives from Canada, Great Britain, France, Switzerland, Sweden, Holland, Italy, and Germany.

William Littlewood

William Littlewood, vice-president, equipment research, American Airlines, has been chosen to receive the 1958 Daniel Guggenheim Medal *for leadership and continuous personal participation over a quarter of a century in developing the equipment and operating techniques of air transport.*

Mr. Littlewood, Mem. ASME, past-president of SAE, and American Honorary Fellow of IAS, is internationally known for his contributions in the development of many widely used American commercial air transports. These include the Convair and Douglas series as well as the Lockheed Electra and Boeing 707.

After serving an enlistment in the U. S. Navy during World War I, William Littlewood received his ME degree in 1920 from Cornell University. He taught there on the staffs of the physics, mechanics, and machine-design departments. In 1927 he entered the aviation industry with the Fairchild Engine and Aircraft Company. In 1930 he moved to American Airways, Inc., the predecessor of American Airlines, Inc.

Mr. Littlewood was for ten years a member of the executive committee of the National Advisory Committee for Aeronautics, and continues to work actively with several of its committees. During World War II he served as chairman of a committee of Air Force, Navy, and civilian aviation personnel charged with the standardization of air-transport aircraft. After the war he was intimately associated with the early discussions resulting in the determination and development of all the larger American turbine-type jet transports now under active construction.

Worcester Reed Warner Medal

The Worcester Reed Warner Medal was established in 1930 by bequest of Worcester Reed Warner, charter member and sixteenth President of the Society. It is awarded for an outstanding contribution to the permanent literature of engineering. In order to qualify for consideration, such literature must be not less than five years old and be recognized as a noteworthy contribution to the profession.

Rose

Harold James Rose

Harold J. Rose, Mem. ASME, vice-president and consultant, Bituminous Coal Research, Inc., Pittsburgh, Pa., is awarded the 1958 Worcester Reed Warner Medal *in recognition of the valuable work which he has done in investigating and reporting the characteristics of coals, the benefaction of coal by various processes and the use and control of combustion by-products, specifically fly ash and atmospheric contaminants.*

Mr. Rose was born in Pierre, S. Dak., and educated at Yankton College, the University of Chicago, and the Carnegie Institute of Technology. He has spent all of his 40 years of professional life in fuels research, equipment design, and preparation and use of bituminous coal, coke, and anthracite. Holder of 28 patents on coal-processing methods, equipment, and products, he has written 90 papers reporting on the results of his research and other work in this fi :ld.

Mr. Rose received the Grasseli Medal of the Society of the Chemical Industry in 1928, and in 1932 was the recipient of an honorary degree of ScD from Yankton College.

Melville Prize Medal

The Melville Prize Medal for Original Work was established in 1914 in honor of Admiral George Wallace Melville, Honorary Member and eighteenth President of the Society. It is awarded annually for the best original paper or thesis on a mechanical engineering subject by a member of ASME presented for discussion and publication during the preceding calendar year.

Thomas Paton Goodman

Thomas Paton Goodman, Assoc. Mem. ASME, kinematics engineer in the General Engineering Laboratory, General Electric Company, Schenectady, N.Y., is awarded the 1958 Melville Prize Medal for Original Work *for his paper "An Indirect Method for Determining Accelerations in Complex Mechanisms."*

This paper resulted from research conducted in 1956 and 1957 under a Guggenheim Fellowship and a Fulbright senior research grant for research on kinematics of mechanisms at the Technical University, Munich, Germany.

Mr. Goodman was born in Chicago, Ill., and received his BS degree in mechanical engineering from Northwestern University in 1945. After a year of Naval service and a year as an instructor at Northwestern University, he joined the Westinghouse Electric Corporation. In 1950 he left to spend two years as a Rhodes Scholar in the honor school of mathematics at Oxford University and then went to Massachusetts Institute of Technology where he earned his doctorate in mechanical engineering in 1955. From 1954 to 1958 he was an assistant professor of mechanical engineering at M.I.T.

Dr. Goodman has written a number of papers in the fields of kinematics of mechanisms and automatic control.

ASME George Westinghouse Gold Medal

The ASME George Westinghouse Gold Medal, which was first presented at the Society's 1953 Annual Meeting, is bestowed annually, if warranted, for eminent achievement or distinguished service in the power field of mechanical engineering. It was established to perpetuate the value of the rich contributions to power development made by George


Goodman


Fairchild


Estcourt


von Karman


Nadai

Westinghouse, Honorary Member and 29th President of the Society.

Frederick P. Fairchild

Aggressive instigator of progress in the art of designing and installing high-efficiency steam-generating stations; supreme in his ability to achieve prudent and consistent advances in the field.

Frederick P. Fairchild, chief engineer, Public Service Electric and Gas Company of New Jersey, was an early advocate of pulverized-fuel firing and the large boilers thus made possible. He is recognized as one of the first to use the "austenitic" type of steel alloy in high-temperature, high-pressure power-plant piping and to promote its use until the entire industry had accepted it. He is also a proponent of the high-speed turbine generators now also accepted by the power industry.

Mr. Fairchild was born in Kansas and received his BS degree in mechanical engineering from the University of Kansas in 1910. Prior to joining Public Service of New Jersey in 1937, his career included service with the Allis-Chalmers Company, San Diego Consolidated Gas and Electric Company, Stone and Webster Construction Company, and United Engineers and Constructors, Inc.

Author of many works on steam generating and equipment, Mr. Fairchild is a Fellow of ASME. He was awarded an honorary doctorate in engineering by Stevens Institute of Technology in 1951.

Prime Movers Committee Award

The Prime Movers Committee Award was established in 1954 from a fund donated by the Prime Movers Committee of the Edison Electric Institute. It is conferred annually in recognition of outstanding contributions to the literature of thermal-electric station practice or equipment.

Vivian F. Estcourt

Vivian F. Estcourt, Fellow ASME, general superintendent of steam generation, Pacific Gas and Electric Company, San Francisco, Calif., was awarded the 1958 Prime Movers Committee Award *for his paper "Plant Management and Other Factors Affecting Maintenance Costs in Steam-Generating Stations."*

Mr. Estcourt was educated at Stanford University in mechanical and electrical engineering and has been associated with PG&E continuously since 1923. Serving the company in various capacities, he has been primarily involved in the fields of design, and the operation and management of steam-electric generating stations.

His present responsibilities include the management and operation of the company's thermal-power system which has grown from an installed capacity of 1,200,000 kw in 1950 to its present size of 3,300,000 kw, including one jointly owned and operated nuclear plant. He has made important engineering contributions in the development of plants for fast load-pickup and wide load-range operation, automatic control applications, and in the invention of several improvements in the design of combination oil and gas burners.

Mr. Estcourt is a past-chairman of the ASME San Francisco Section and was a recipient of the Society's 75th Anniversary Medal. He was elected a Fellow of the Society in 1954, and is Pacific Coast Representative of the Power Division Executive Committee, Member of the Standing Committee on Power Test Codes, and Advisory Member of the Power Test Codes Committee on Steam Turbines. Mr. Estcourt is also a member of numerous other engineering and management organizations and is the author of many technical papers in his field.

Timoshenko Medal

The Timoshenko Medal was established in 1957 to be conferred annually in recognition of distinguished contributions to applied mechanics. It was instituted by the Applied Mechanics Division of the Society to honor Stephen P. Timoshenko, world-famed authority in the field, and to commemorate his contributions as author and teacher.

Theodore von Karman

Theodore von Karman, Mem. ASME, Chairman of the Advisory Group for Aeronautical Research and Development to the North Atlantic Treaty Organization (NATO), is awarded the Timoshenko Medal *for his contributions to the mechanics of fluids and solids, particularly those leading to major advancements in aeronautics.*

Founder of the Aerojet-General Corporation of California, Dr. von Karman now acts as consultant to the company. He is chairman-emeritus of the Scientific Advisory Board to the Chief of Staff of the United States Air Force and has been consultant to the U. S. Government on many projects. He has also acted as consultant to many private firms in the aircraft industry.

Dr. von Karman earned his doctorate in philosophy from the University of Göttingen, Germany, and holds 17 honorary degrees. He is Professor-Emeritus of the California Institute of Technology and Honorary Professor of Colum-

bia University. He was the recipient of the Daniel Guggenheim Medal in 1955.

Arpad L. Nadai

Arpad L. Nadai, Fellow ASME, former consulting mechanical engineer for the Westinghouse Research Laboratories, is awarded the Timoshenko Medal *for his contributions to the theory of elastic plates and the flow and fracture of solid bodies.*

Born in Budapest, Hungary, Dr. Nadai was educated at the Swiss Technical Institute in Zurich and received his doctorate in engineering from the Technical University in Berlin in 1912. He worked in Zurich under Dr. Aurel Stodola, noted authority on steam and gas turbines. After service in the Austro-Hungarian Army in World War I, he joined the University of Göttingen in 1919 and became professor of applied mechanics in 1923.

In 1927 he joined the Westinghouse Research Laboratories in East Pittsburgh, Pa., as consulting mechanical engineer. Here he carried on many investigations on the flow and fracture of metals at normal and high temperatures and conducted graduate courses on the theory of elasticity and plasticity in the mechanical design school arranged jointly by Westinghouse Electric Corporation and the University of Pittsburgh.

During and after World War II Dr. Nadai was a consultant at the David Taylor Model Basin of the U. S. Navy Department on problems of strength. He is an adviser to the National Research Council, National Academy of Sciences. He received the Society's Worcester Reed Warner Medal in 1947.

Geoffrey I. Taylor

Sir Geoffrey I. Taylor, former Yarrow Research Professor of the Royal Society, Cambridge, England, is awarded the Timoshenko Medal *for his many fundamental contributions to a better understanding of the mechanics of solids and fluids.*

Sir Geoffrey was born in London, England, and educated at University College School, Cambridge. He was meteorologist to the Scotia expedition to the North Atlantic before World War I. During the war he was engaged in experimental aeronautics and meteorology and obtained his pilot's certificate in 1915.

Sir Geoffrey was one of the scientists who worked in Los Alamos, N. Mex., in 1944–1945 preparing for the first nuclear explosion. He has written numerous papers, is an Associate of the U. S. National Academy of Sciences, an Honorary Fellow of the Institute of Aeronautical Sciences, and an Honorary Member of The Institution of Mechanical Engineers.

Richards Memorial Award

The Richards Memorial Award, established in 1944, was named in honor of Charles Russ Richards, founder of Pi Tau Sigma, honorary mechanical engineering fraternity. It is given annually for outstanding achievement by a mechanical-engineering graduate within 20 to 25 years after graduation from the regular mechanical-engineering curriculum of a recognized college or university.

Donald C. Burnham

Donald C. Burnham, Mem. ASME, vice-president of manufacturing, Westinghouse Electric Corporation, has been selected to receive the 1958 Richards Memorial Award *for outstanding achievement within 20 to 25 years after graduation.*

Born in Athol, Mass., Mr. Burnham was graduated from Purdue University in 1936 with the degree of BS in mechanical engineering, under the first scholarship given by the Fisher Body Division of General Motors Corporation.

He joined General Motors after his graduation and served first in the AC Spark Plug Division and then in the Ternstedt Division where he was Supervisor of Methods and Plant Layout. In 1941 Mr. Burnham was transferred in the same capacity to the Oldsmobile Division.

During World War II, Mr. Burnham served as a Major in U. S. Army Ordnance and he was assigned to the Watervliet Arsenal as assistant to the works manager.

Returning to the Oldsmobile Division of General Motors after the war, he was advanced to manager of manufacturing and assistant chief engineer. In 1954 Mr. Burnham left General Motors to become vice-president of manufacturing for Westinghouse Electric Corporation.

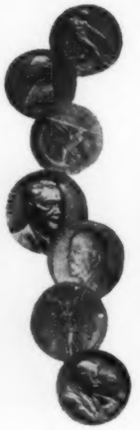
He is a member of Tau Beta Pi and Pi Tau Sigma honor societies. In 1958, he received an honorary DE degree from Purdue University.

Pi Tau Sigma Gold Medal Award

The Pi Tau Sigma Gold Medal Award was established in 1938 through an endowment by Pi Tau Sigma, national honorary mechanical engineering fraternity. It is awarded annually for outstanding achievement in mechanical engineering within ten years after graduation from the regular mechanical-engineering curriculum of a recognized college or university.

Allison Kent Simons

Allison K. Simons, Assoc. Mem.



Taylor

ASME, director of engineering and research of the Bostrom Corporation, and director of the Bostrom Research Laboratories, Milwaukee, Wis., was selected to receive the 1958 Pi Tau Sigma Gold Medal Award *for outstanding achievement within ten years after graduation.*

Mr. Simons started his career as a draftsman, then as loftsman, linesman, and wing-group engineer at Bell Aircraft Company in Buffalo, N. Y. After a tour in the Navy during World War II and night courses at Millard Fillmore College and Corpus Christi Junior College he returned to Bell Aircraft. He obtained his degree in mechanical engineering from the University of Buffalo *cum laude* in three years, graduating in 1950.

He joined the Bostrom Corporation in 1950 as a research engineer; was made chief engineer in 1952 and was promoted to his present position in 1956.

He has served as chairman of the ASME Milwaukee Section. He is currently chairman of the Human Factors in Engineering Committee and is one of the charter members of the Human Factors Society of America.

Charles T. Main Award

The Charles T. Main Award was established in 1919 from a fund created by Charles T. Main, past-president of the Society, to be awarded for the best paper by a student member concerning the influence of engineering on public life.

Frank D. Sams

Frank D. Sams was born in Greenville, S. C., and attended the Calhoun-Clemson High School.

At Clemson College, where he is enrolled, he is a cadet captain in the ROTC,

Burnham

Simons

Sams

Woolcott

Hollingshaus

associate editor of "The Slipstick," and a member of several honor societies.

Mr. Sams won the Charles T. Main award for his paper, "Student Development of Professional Engineering Attitudes and Ethics."

Undergraduate Student Award

The Undergraduate Student Award, established in 1914 from a fund created by Henry Hess, past-vice-president of the Society, is presented for the best paper or thesis submitted by a student member.

Robert E. Woolcott

Robert Earl Woolcott was graduated from Queen's University, Kingston, Ont., Canada, with the BS degree in mechanical engineering in May of 1958. He is now a junior engineer with General Motors of Canada.

Mr. Woolcott won the Undergraduate Student Award for his paper, "The Measurement of the Components of Front End Alignment."

Old Guard Prize

The Old Guard Prize was established in 1956. Winners are selected through a series of regional competitions with a final decision being rendered by a panel of judges at the ASME Semi-Annual Meeting. The award is made possible by members of the Society who, through long membership or age, have reached a dues-exempt status, but who contribute funds for worth-while purposes.

Harry Hollingshaus

Harry Hollingshaus is a native of Salt Lake City, Utah, and attended schools there. Before entering the University of Utah, he served as a missionary for the Church of Jesus Christ of the Latter Day Saints in Switzerland, and in the U. S. Army. He was graduated with honors from College in June, 1958, and is now a project test engineer in the General Electric Vallecitos Atomic Laboratory.

He won the Old Guard Prize for his paper: "Correlation of Mechanical Properties of Bone With Radiation Damage."

ASME Lecturers 1957-1958

The ASME Lectures were instituted to bring to Sections of the Society, on a biennial basis, outstanding speakers on subjects of broad general interest and value to members of the mechanical-engineering profession. During the several years that the Lectures have been established, leading engineers have been selected for this service. The selection is, in itself, an honor. The Lecturer donates his time and receives no honorarium.

The following is a list of the 1957-1958 ASME Lecturers and their topics:

Howard Aiken, Director, The Computation Laboratory, Harvard University, Cambridge 38, Mass.

Topic: Computing Machinery.

Myron C. Beekman, Mem. ASME, Director, Nuclear Power Development Department, The Detroit Edison Company, 2000 Second Avenue, Detroit 26, Mich.

Topic: Application of Nuclear Energy to the Production of Electrical Power.

W. F. Jessup, Supervisor, Automation Section, Engineering Service Department, Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, Ohio.

Topic: Machine-Tool Automation.

P. Frank Martinuzzi, Mem. ASME, Professor of Mechanical Engineering, Stevens Institute of Technology, Hoboken, N. J.

Topics: Automotive Gas Turbines. Latest Developments in the Gas Turbine Field. The Future of Atomic Power Plants.

John W. Mauchly, Director, UNIVAC Applications, Research Center, Remington Rand UNIVAC, Division of Sperry Rand Corporation, 19th Street & W. Allegheny Avenue, Philadelphia 29, Pa.

Topic: Computing Machines.

John R. Menke, Mem. ASME, President, Nuclear Development Corporation of America, 5 New Street, White Plains, N. Y.

Topic: Physics and Engineering of Atomic Power Theory.

Herbert F. Mitchell, Jr., Director of Applications, Remington Rand Division of Sperry Rand Corporation, 2601 Wilshire Boulevard, Los Angeles 57, Calif.

Topic: Computers and Their Use by Engineers.

Glenn Murphy, Mem. ASME, Head, Department of Theoretical and Applied Mechanics, Iowa State College, Ames, Iowa.

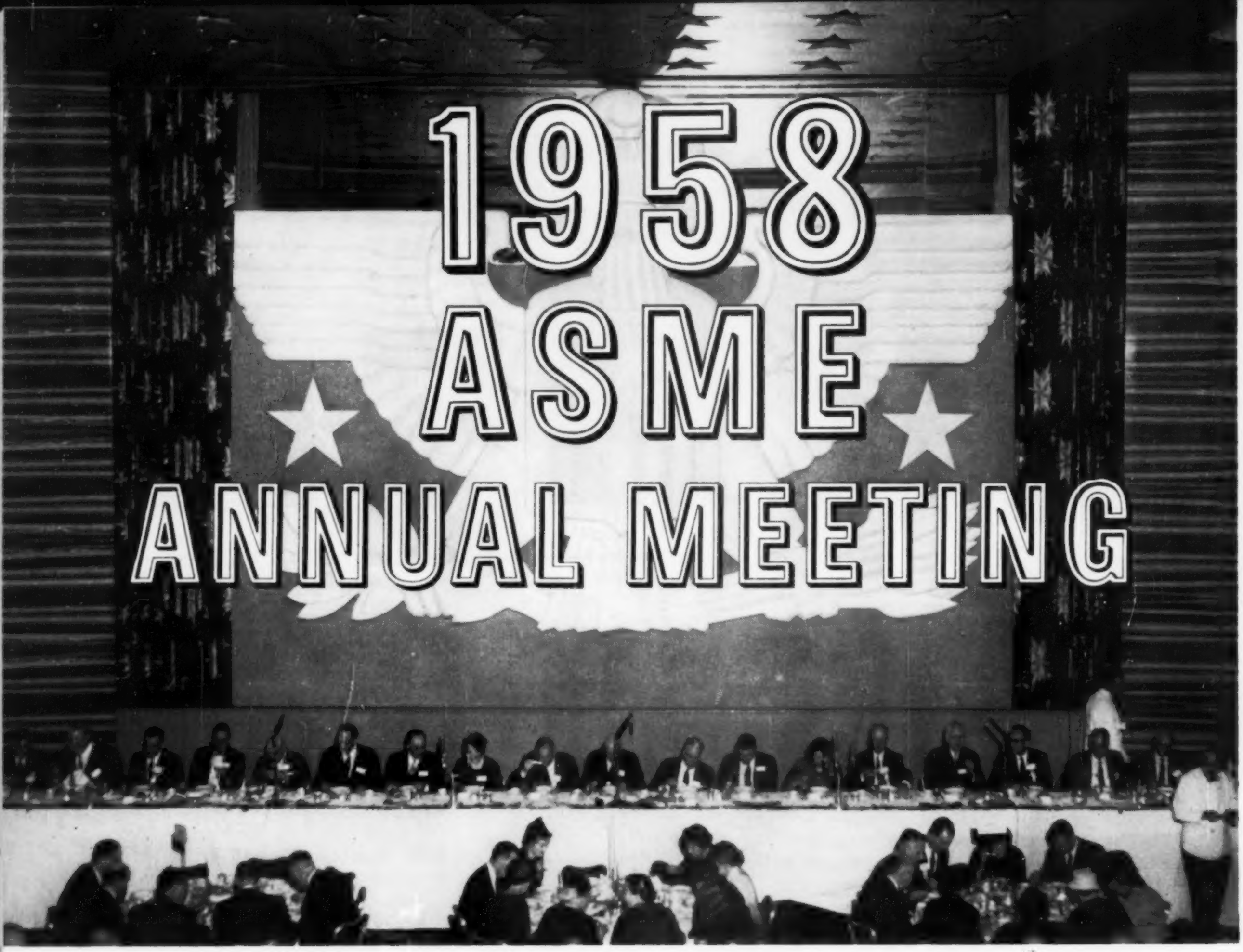
Topic: Nuclear Power Development.

Dr. C. G. A. Rosen, Hon. Mem. ASME, Consulting Engineer, 1501 Portola Road, Woodside, Calif. (formerly with Caterpillar Tractor Co., Peoria, Ill.).

Topic: In Quest of Engineering Creativeness.

Willis R. Woolrich, Fellow ASME, Dean of Engineering, College of Engineering, The University of Texas, Austin 12, Texas.

Topics: Sky Cooling and Condensation Control in the Air-Conditioning of Buildings. The Solution of High Energy Living by Human Beings in Hot Climates.



New Frontiers in Engineering—Key to Mankind's Progress

The 79th Annual Meeting of The American Society of Mechanical Engineers was held November 30–December 5, 1958, at the Hotels Statler Hilton and Sheraton-McAlpin, New York, N. Y. Total registration of engineers, their wives, and guests was 5734. The theme of the meeting was "New Frontiers in Engineering—Key to Mankind's Progress."

The 23rd National Exposition of Power and Mechanical Engineering, under the auspices of the ASME, was held at the same time in the New York Coliseum at Columbus Circle. There were 290 exhibits occupying two floors of the great exhibition hall. Notable was the large number of exhibits showing heavy equipment. Attendance at the Power Show exceeded 20,000. See pp. 111–113.

The "new frontiers" were apparent in the papers presented at the technical sessions, engineers moving into areas of science and application never before attempted. A new frontier was evident in the struggle toward more effective technical education—there were papers on many aspects of the training of both nondegree technicians and degree engineers. Cutting across all divisions and society boundaries was the urgent problem of professional unity. Leaders, meeting in conference, discussed means for achieving unity.

At the President's Luncheon, first important general gathering of the Annual Meeting, outgoing ASME President J. N. Landis spoke on "The Importance of Local Engineering Councils in the Development of Engineering Unity." His theme: that unity begins at the grass roots.

In the five days of technical sessions, there were 130 sessions at which 392 papers were presented. Peacetime applications of nuclear fission and fusion, design of jet transport planes (including the latest Soviet aircraft), and new developments in control of the automatic factory were among the topics discussed.

This was the first time in more than a decade that the ASME's affiliate, the American Rocket Society, has not held its annual meeting with the ASME. In the past two years the Rocket Society has grown to such proportions that there would not have been room for both meetings at once.

The ASME Annual Meeting is the time the Society's new President takes office. Glenn B. Warren, vice-president and consulting engineer—Turbine Division, General Electric Company, Schenectady, N. Y., became President of the ASME for 1959.

In the following pages, we present the high lights of the 1958 ASME Annual Meeting.

Professional Unity

The Sunday evening session sponsored by the Council, Boards, and Committees of ASME was a discussion of professional unity. Outgoing ASME President James N. Landis reviewed the steps that had been taken, particularly under his personal directive "to seek collaboration of other societies on unity and the Functional Plan." He has been actively following this directive in meetings with the presidents of other societies.

Edgar J. Kates outlined the proposal for an American Engineering Association with board representation for each society. An executive committee would be composed of 12 directors. The functional organization would consist of three main divisions: An Education Division, a Technical Division, and a Professional Division. These would each have a series of committees for particular purposes within their spheres. The divisions would correspond roughly to existing organizations and absorb some of their personnel and functions. The Education Division would be similar to ECPD and the Technical Division would be similar in many ways to EJC. There was some difference of opinion as to how the Professional Division would be organized. It was hoped that the National Society of Professional Engineers would join the Association and provide personnel and effort on this type of problem. Mr. Landis stated that the plan was not rigidly defined and could be shaped.

ASME Past-President W. F. Ryan stated that the idea of professional unity was older than he was. According to information supplied by ASME Editor Emeritus George A. Stetson, there was an 1886 address before the American Association for the Advancement of Science on unification of the engineering societies, and a proposal was made in 1889 for an Academy of Engineering, and four ASME presidential addresses on the subject of unification dated back to 1908.

"Like nearly everyone else," Mr. Ryan had had his own "perfect plan" for unification 25 years ago, but had modified his ideas since then. Progress, he stated, was being made and a presidential task force, consisting of Mr. Landis and the presidents of other societies, had been steadily working away at one aspect after another.

The American Engineering Association proposal was described as "taking three existing organizations and putting an umbrella over them." An alternative proposal was to "use what we've got" and confine the existing organizations to their primary functions: ECPD to the educational aspects, EJC to technical co-ordination, and NSPE to professional activities.

Joseph Pope outlined the function of EJC which was organized in 1941 and incorporated July, 1958. A "federation of engineering societies," it is divided into three categories. There are 11 "constituent" societies, each of which has more than 5000 members. There are four "associate" societies which have less than 5000 members each. The third category is for regional organizations with six societies in this "affiliate" group.

Only constituents vote, and the executive committee is composed of the president, vice-president, and one other member of each constituent society. About 250,000 members of individual societies are represented by EJC, and the study of unification represented action on a request by EJC for information on how it could be improved.

William H. Larkin drew a humorous analogy to the 400 Puritans who were divided into 300 sects at the time they migrated to Holland, where they learned what they had in common. He stated that engineers have learned that they have many interests in common and can get together to do a good job when it is required. He asked if they are ready for permanent unification.

He cautioned that ECPD is mentioned in 41 separate registration acts, and in view of the difficulty of getting even one state legislative act changed, ECPD must be preserved in whatever form unity may take.

He mentioned that engineers seem to follow a 20 per cent rule when it comes to individual joining. Of the 220,000 registered engineers, about 46,000 belong to NSPE. Of the 325,000 engineers who could be considered potential Members of the Five Founder Societies, about 60,000 are of full member grade.

NSPE has an advantage at the state level, where legislators look to state societies for guidance in engineering matters. NSPE can be of similar aid in Washington, where there is an able staff that is listened to with respect. NSPE has 2½ times the membership of any of the full-member-grade totals of any of the Founder Societies. The question would seem to be how to bring NSPE into the fold.

Attention was called to the tax problem. The technical societies are tax exempt under 501(*c*)(3) as educational and Scientific societies. This category permits contributions to be tax exempt. NSPE, the American Medical Association, and the American Bar Association are tax exempt under 501(*c*)(6) as business leagues. One of the major factors which determines this is the substantial amount of legislative activity. AIEE, on the advice of counsel, has deleted the phrases on professional development in its constitution for that reason.

Civil engineers were thought to outnumber other types in the present disciplinary grouping of NSPE, but electricals and mechanicals have been increasing. Mr. Larkin felt that the percentages would roughly follow those of examining boards which were: 56 per cent civil, $16^1/_2$ mechanical, $18^1/_2$ electrical, and 7 each for chemical and mining engineers. A quick poll of engineers present disclosed that for the 138 cards returned, 102 were registered, and 37 NSPE members.

E. J. Kates explains professional-unity organization while, *left to right,* ASME President J. N. Landis, past-president W. F. Ryan, and Joseph Pope look on

AIEE has offered to urge its members to join NSPE if the registration requirement is dropped. A poll in September of 13,000 Fellows and Members indicated that of the 7400 represented by valid returns, 63 per cent were registered, and 46 per cent of those registered belonged to NSPE. If the registration requirement were dropped, 71 per cent indicated that they would join NSPE.

NSPE has extended an invitation to the Founder Societies to send a representative to their board at NSPE's expense, and has offered to give such representatives the floor when desired. Communication in both directions is sought.

Technical Program High Lights

At this 1958 Annual Meeting, the technical sessions were notable for brief presentations of papers and rewarding discussions. It would seem that engineers are mastering a new art, that of talking to an audience of engineers somewhat as though they were speaking to their fellow workers in plant and laboratory—the informal, uncluttered presentation. This leaves time for that thorough discussion which brings out the hidden viewpoint, the unexpected disclosure of fact and experience.

A number of the Society's Research Committees took an important part in the technical sessions, presenting both technical papers and progress reports. Progress reports on the co-operative research undertaken by the ASME serves to bring industry and individual engineers up to date on the directions of current and pending research, an important meeting of the minds.

A list of the Meeting's technical papers —authors, titles, and ASME numbers— appears in this issue, pp. 97–101. In addition, all papers which are not scheduled for publication in Mechanical Engineering will be abstracted in "ASME Technical Digest," some in this issue, others in succeeding issues. Altogether, there were 130 technical sessions at which 392 papers were presented.

The ASME encompasses 24 Professional Divisions and 21 research committees, most of them represented by papers at the Annual Meeting. Here are some of the high points:

Applied Mechanics. Fifteen of the 59 papers presented at sessions of this division were in the fields of fluid mechanics and thermodynamics. This represents a significant trend compared with previous meetings, where only a small number of papers from these fields were offered. Most of the papers in fluid mechanics dealt with the problems of viscous flow, concentrating heavily on boundary-layer effects with and without heat transfer.

Twenty-eight papers on elasticity and plasticity continued in the tradition of the Division to penetrate deeper into the behavior of solids. Example: "Stress Distribution and Plastic Deformation in Rotating Cylinders of Strain-Hardening Material." In some cases, the variables of time and temperature were added. This was probably due to the influence of the missile program, where unsteady time and temperature effects are important.

A significant number of papers took up problems in dynamics, vibrations, and kinetics.

Hydraulics. Papers from the Hydraulic Division placed more than the usual emphasis on basic fluid-mechanics research. This change was stimulated by the Fluid Mechanics Subcommittee: The activities of this subcommittee are apparent from the fact that it had sessions scheduled for all five days of the meeting.

A noteworthy paper sponsored by this subcommittee was "Unresolved Problems of Fluid Mechanics," by S. J. Kline and R. C. Dean, Jr. (Mechanical Engineering, December, 1958, pp. 54–55). Outstanding was the two-day symposium on "Stall in Fluid Flow" (separation of flow from the boundary surfaces of internal-flow systems, and fluid mechanics).

The Division's program included papers and sessions on hydraulic prime movers, water hammer, cavitation, pumping machinery, and compressors and fluid power systems.

Instruments and Regulators. Six of the IRD papers stressed education in control technology. This reflects the growing consensus within the Division that an ever larger number of technicians, engineers, and scientists are required to support the rapidly expanding and increasingly complex field of control.

A major trend has been the increasingly close co-operation among control engineers in the different societies, four other societies participating in IRD's Conference earlier in the year. Control engineers have crossed geographical boundaries as well as lines of affiliation, as shown at the Annual Meeting panel discussion on "Instrumentation in the USSR," given by members of the American Automatic Control Council.

At one of its sessions, the Division held a panel discussion on instrumentation and control in Soviet engineering. Chairman and speakers were members of that group of 13 American engineers who visited Russia from Aug. 17 to Sept. 2, 1958, each man an expert on control. An engineer from Oak Ridge, reporting on Soviet nuclear reactors, observed that their designs placed less emphasis on safety: Not so much built-in safety as we would require.

The Research Committee on Mechanical Pressure Elements joined the IRD in presenting papers at one technical session.

Metals Engineering. The Metals Engineering papers bore heavily on the analysis of behavior and properties of materials operating in increasingly severe environments.

In one session, creep at elevated temperatures was attacked on several fronts, including analysis of creep behavior, properties of metals subjected to multiaxial stresses, and parameter methods of correlation and extrapolation of existing data to longer operating times.

Thermally induced strain cycling has become recognized as a new and severe environment. One session plus an informal workshop was devoted to analysis of behavior and material properties under conditions of strain cycling. At elevated temperatures, where relaxation of stress can occur, measurable amounts of plastic strain may be induced, leading to fatigue failures.

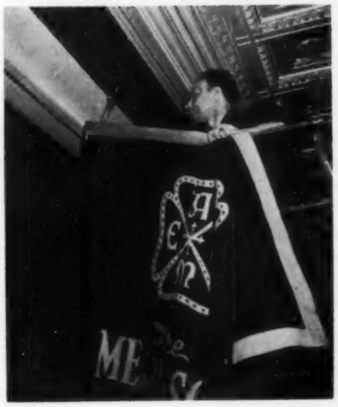
A third environment concerning radiation and associated problems, such as cooling with liquid metals, was dealt with in another session. Increasingly severe environments are coming. As temperatures are required where metals are no longer adequate, composites of metals and nonmetals—or complete nonmetallic materials—may be developed.

The Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals joined the Metals Engineering Division in presenting papers at three sessions. The Research Committee on Plastic Failure of Metals joined in one session.

Lubrication. In the study of lubrication, a new sophistication is apparent: Engineers are tackling more difficult problems. Turbulence, inertia effects, cavitation, and stability—or rather, lack of stability —are under investigation.

There were more papers on hydrodynamics as applied to rolling elements— gear teeth, roller bearings, ball bearings. There was more interest in viscoelasticity as applied to the physical properties of

SETTING THE STAGE

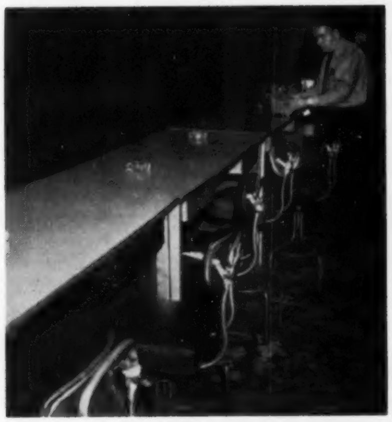


Steady
that
ladder

That
one's
for
the
press
room

Everything
but
costumes

Yes
sir,
Mr. Jones
is
here



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in
business

the lubricants, and its influence in thin lubrication. A paper which will later appear in Mechanical Engineering defined viscoelasticity and discussed its involvement in such mechanisms as high-speed gears and bearings. Here the engineer is searching out the mechanics of a material which will undergo an instantaneous elastic response when stressed, but which can also flow.

With the development of rockets, missiles, and high-speed aircraft, lubrication engineers are coming up against the problems of high temperature (the area around 2000 F) and extremely low temperatures (liquid nitrogen in the cryogenic region).

Heat Transfer. The Heat Transfer Division found itself with an embarrassment of riches, more technical papers than could be considered at one meeting.

In addition to the papers presented at the Annual Meeting, there is another group which will be presented at a special symposium to be held at Purdue University in February, 1959. These are papers on "thermophysical properties" (conductivity, specific heat, density, viscosity, radiation properties, etc.), and they were separated from the Annual Meeting schedule to keep it within manageable limits. Thus the Division will, in effect, have two conferences in 1959: the symposium, at Lafayette, Ind., and the regular Conference which will be held during the summer at the University of Connecticut.

Approval has been obtained for the new *Journal of Heat Transfer*. During 1959, subscribers to the *Journal of Basic Engineering* will receive the new Journal: The following year it is expected to have its own subscription list. Its first issue will appear in February, 1959.

Papers on biotechnology, sponsored by the Heat Transfer Division, appeared for the first time at an Annual Meeting. Beyond this, the 44 technical papers represented a normal balance of theoretical and application papers, ranging from "A Theory of Rotating Condensation," to "Fouling and Cleaning of Power-Plant Heat Exchangers."

Research Committee on Fluid Meters. The Research Committee on Fluid Meters, the ASME's second oldest research committee (it was first commissioned in 1916), held its own technical session on Thursday afternoon at the Statler Hilton. Two papers were presented, one discussing design criteria for obstructionless electromagnetic flowmeters, the other taking up cavitation effects.

Over the years, this committee has produced a series of reports on flow measurement which have become standard works. They have been used as textbooks in technical colleges, and have provided the basis for the formation of flow-measurement sections in power test codes. The latest compilation of their reports is a volume entitled "Fluid Meters—Their Theory and Application."

Boiler Feedwater Studies. During investigations of feedwater-purity requirements for once-through supercritical steam generators, it was discovered that the location of waterside deposits is related to the division of the supercritical region into areas of liquidlike and gaslike properties. Furthermore, when sampling at high pressures, water dissociates across throttling valves into hydrogen and oxygen, making special sampling arrangements necessary.

Recent investigations indicate that tube failures in modern-central-station boilers are frequently the final result of high heat transfer, and that better metals, or better distribution of heat to the absorbing surfaces to avoid "hot spots," rather than chemical treatment, may be the solution.

Two organic acids—formic and citric—although not expected to replace the cheaper mineral-acid "work horses," are superior for certain applications in cleaning steam generators, and indicate the need for further investigation of the use of chemical solvents.

A group of three papers dealt with the use of amines to provide protective films for controlling corrosion in condensate-return lines. While their use on government area-heating systems proved "indifferently successful," utility experience indicated marked reduction in iron and copper concentrations, and improvement of pH values to protective levels.

Gas Turbine Power. The "big event" of the Gas Turbine Power Division at the Annual Meeting was the presentation of the "1958 Gas Turbine Progress Report." This consisted of 12 papers plus the introduction, and was the second report of its type. The first was presented in 1952. A selection of some of the most significant material was published in Mechanical Engineering, November, 1958, pp. 102–110.

Other papers were presented on gas-turbine component parts including heat exchangers. There were also joint sessions with the Aviation and Heat Transfer Divisions, and a Marine Symposium on operating experience with gas turbines was held.

Fuels. A symposium on flame-failure protection for large boilers agreed on the need for standards for such devices. Those attending the session voted overwhelmingly in favor of establishing a committee to set up the necessary standards. At present flame-failure devices are not a cure-all. More research and development are needed, and the desired protection can best be brought about by system interlocks that will integrate and balance together a combination of devices.

The forms in which sulfur occurs in coal, its relation to combustion efficiency, corrosion, and air pollution, and the possibility of removing it at the pulverizing stage were explored. Removal is too expensive to be practical except where particle size is large enough to permit gravity differentiation or other mechanical means of separation. The sulfur compounds were also important in a critical review of the literature on corrosion and deposits made by Battelle Memorial Institute to define the gaps in knowledge for the Research Committee on Corrosion and Deposits.

The use of nuclear energy for chemical process heat, and the development of a fuel cell for the direct conversion of electricity from fossil fuels were examined.

Ultrasonic energy was shown to increase the evaporation rate as much as 50 per cent in a study of its effect on fuel drops. Another study demonstrated the qualitative and quantitative aspects of induced air flow in and near the penetration zone of hollow and solid-core fuel sprays.

A symposium of furnace and burner model testing under the auspices of the Research Committee on Furnace Performance Factors and the Fuels Division described the growing application of model and water-table studies to furnace design.

Nuclear Engineering. The nuclear-engineering papers were not preprinted. Some of the American research reported at Geneva was described. The use of nuclear fission for industrial heat, exploratory studies on power generation from radioisotopes, and from nuclear and thermodynamic explosions, as well as the direct conversion of plasma energy into electricity were topics of the opening session. Fundamental research on the growth mechanism of graphite under radiation and the conversion of high-energy radiation to storing chemical energy was also reported.

In this research at Brookhaven, it has been discovered that there is a sudden rapid release of 50 calories per gram when graphite is heated in an annealing furnace. The annealing is done to allow the ions which have been displaced to an interstitial position in the lattice to return to their original positions and restore the graphite to its original shape. A similar reaction in copper releases 3 to 5 calories per gram. Polymers gamma-irradiated in the presence of

TECHNICAL SESSIONS

IRD.
Chairman Shearer:
"We have two
prepared discussers"

Dr. Westcott,
London, England:
"...to my fellow
educationalists..."

Slater
of New York:
"This split-level
education..."

Power.
Richardson
of Dupont:
"Industry
wants
continuous
power."

Authors of the
Gas Turbine Progress Report.
Back row, *left to right,* W. M. Kays,
A. D. Foster, J. B. Esgar, J. W. Sawyer,
W. M. Meyer, A. W. Herbenar. Front row,
left to right, R. Tom Sawyer,
P. R. Broadley, A. H. Senner, C. E. Mines,
P. F. Martinuzzi, E. S. Dennison.

Heat Transfer.
Tribus of UCLA:
"We may visualize
the flow..."

Irvine of
U. of Minn.:
"Without exceeding
limitations..."

Chairman Kezios:
"In February, our
new Journal of
Heat Transfer..."

Crowd
at GTP
Technical
session
overflows
into the
foyer

Aviation. Chairman Littlewood, *left,*
American Airlines, with J. T. Ready, Jr., Convair

oxygen produce free radicals when heated. The amount of energy stored is very much a function of the temperature at which irradiation takes place. Lower temperatures permit longer storage. Ordinary refrigeration keeps the energy dormant until suddenly released in heating, but the amount stored is such a small percentage of the weight that technological breakthroughs are needed before it can be utilized.

Twenty available reactor designs were evaluated in relation to industrial heat. Industry consumes 20 per cent of the total Btu's produced in the U. S., exceeding the total used in generating electricity. Although nuclear reactors will generally compete only in areas of highest-cost fuels, institutions with difficult load factors, remote military installations, and some urban district heating offer areas for application. Saline water conversion, which is coming into use as it becomes economically competitive, requires millions of lb per hr of steam at high load factors, and offers another field for nuclear application.

Radioisotope power production appears desirable for low-level long-time applications—10 watts over a period of a year or two seems most practical, and solid-state conversion with thermoelectric devices is practical up to 100 watts. Such uses are important since only 1/1000 of 1 per cent of radioisotope fission products will be used by 1965 unless the present uses are augmented.

The nonmilitary uses of nuclear and thermonuclear explosions have been widely reported and would be suitable for underground generation of power and mining techniques in which the first stage of refining would be combined with excavation. Exploratory applications are needed.

The direct conversion of plasma energy into electrical energy was considered although fusion power production has not yet been achieved. Oversimplified, the fusion development problem is one of creating a plasma with temperatures on the order of 30 or 40 million K and magnetically confining the plasma so that it will not be cooled by contact with the walls of the apparatus.

A panel reviewed the progress of thermonuclear experiments at Oak Ridge, University of California Radiation Laboratory, Los Alamos, and Princeton. One panel member stated that naively the problem was like trying to compress a child's balloon with soapy fingers. Plasma instabilities of both hydromagnetic and electrical nature have been the bane of the experimenter's existence. Impurity control has been another major problem.

It is much too early to predict what type of machine will be the ultimate power producer, and it is still not certain that a thermonuclear reaction has taken place, although Scylla at Los Alamos may have achieved one in the neighborhood of 10 million deg. The DCX, direct-current experiment, at Oak Ridge is the only experimental machine that operates in a steady state.

The experimeters were agreed that fusion power will be attained in the not too distant future, although this does not mean in a year or two. They were not as skeptical as those who claimed that it would not be achieved before the end of the century.

In the fission field, conceptual studies are still being broadened. Molten-salt power reactors were described. Five possible designs of heavy-water reactors utilizing the boiling-water principle would have electrical outputs up to 300 mw, and use nuclear superheat in some designs.

Other sessions dealt with the special problems of containment and safety.

Oil and Gas Power. From a radioactive-oil-consumption study to determine the duration of initial rapid cylinder wear, it was concluded that oil consumption is independent of wear—at least during run-in. The duration of the initial wear period is still in question, but the general feasibility of using tracer techniques was demonstrated.

A method of suppressing engine-exhaust noise was based on a reasonably simple method of predicting accurately the frequency spectrum and intensity of the noise emitted.

Other topics were a method of determining the energy content of the pressure pulses formed by exhaust blowdown in order to assess the efficiency of blowdown under different conditions, and electric-analog simulation of a reciprocating compressor.

Power. More than 20 papers were presented by the Power Division on some of the management, equipment test, design, technical literature, maintenance, operations experience, and conceptual aspects of the power field.

The use of coal, both as a source of gaseous products and as fuel, was considered for a combined steam-gas-turbine cycle. Air, recycled char, and pulverized or crushed coal would be injected concurrently into a carbonizer. There the coal would be heated to about 1000 F by internal combustion of 5 per cent of the fixed carbon to drive most of the volatile constituents from the coal in gaseous and vapor form. The fixed-carbon and ash char would be continuously withdrawn for boiler fuel. The gases would not only drive the gas turbine, but the char would be burned in the hot exhaust gases. The gas turbine would be integrated with the steam plant in the exhaust-heat-recovery cycle.

The surface requirements and performance of cross and counterflow cooling towers were compared. A consideration of the thermal and economic factors in the application of hydraulic couplings to the boiler-feed-pump drives led to the conclusion that the additional expense was justified only if maintenance costs would be reduced and equipment life extended. Optical methods of vapor-purity testing, particularly with the sodium-tracer technique, were explored in relation to the current low total-dissolved-solids requirements.

Thermal performance of the Philo supercritical unit, initial operation with the first monotube once-through boiler at subcritical pressure, and graphitization failures in high-pressure piping were operational-experience topics.

The flow-weighted enthalpy of extraction steam was developed as a useful new performance criterion for steam-turbine regenerative cycles and advocated for design and performance monitoring.

Experience with shot cleaning of economizers, tubular air heaters, and boiler sections with temperatures below those for ash softening was detailed.

The problem of thermal distortion or thermal instability of turbine rotors was brought up to date with an explanation of each of the four basic causes, and a modified heat test was developed that would permit proper detection.

The requirements for good utility relations with industry, particularly in regard to purchased utility services and a co-operative agreement between a utility and a refinery were topics of interest to utility management. The importance of uninterrupted and fluctuation-free service was stressed.

Solar Energy. A discussion of energy storage and selective-absorptive surfaces was held under the auspices of the Solar Energy Application Committee. A fourfold to tenfold reduction in storage costs is needed to make small stationary solar power plants economically competitive with other sources of electrical energy. The nickel-cadmium battery systems, although expensive, are the best storage media currently available.

Laboratory simulation of solar generating systems is possible if light sources and absorbing surfaces are selected which have the proper spectral behavior. With a true "black body," surface configuration would be unimportant since by definition it is totally absorbing. However, most surfaces fall in the

TECHNICAL SESSIONS

"gray" category and surface properties do have some effect. A test of concave, convex, dimpled, and corrugated surfaces determined that a corrugated surface could be used without sacrifice of absorbing characteristics. Since this configuration is used to add strength to many materials, it may well be chosen.

Aviation. Recent years have seen spectacular progress in the aircraft industry—spectacular progress attended by practical problems—and these absorbed the interest of the large groups in attendance at sessions of the Aviation Division.

Certain phases of the aircraft industry are advancing as rapidly as the jets which cross the ocean in six hours, while others are moving as slowly as the ground-handling equipment at outdated airports. In this particular area vertical and short-field landing and take-off aircraft (VTOL and STOL) were mentioned as potential solutions.

High altitudes, high speeds, capacity, all-weather capability, environmental control within the aircraft, and mechanical-system design philosophy all contributed to increased complexity of the modern aircraft. Increased complexity, while it makes demands on the designer and manufacturer, also requires optimum performance from operators. Human factors engineering enters here to attempt to solve the problems of men in space.

As the machinery which makes up modern giant air transports becomes more sophisticated, new methods of efficient manufacturing must be developed. Two of the Aviation Division's sessions were devoted to symposiums on the new art of numerical control of machine tools and constituted a valuable progress report on the state of the art.

Application of engineering theory to problems ranging from the design of missile nose cones to the torque in gimbal systems were reported. A number of papers were presented jointly with the Heat Transfer Division.

In the background—*Aviation Week* announced that "A nuclear-powered bomber is being flight-tested in the Soviet Union."

Machine Design. In addition to the six sessions sponsored solely by the Machine Design Division, a number of sessions were held jointly with the Aviation, Instruments and Regulators, Production Engineering, and Safety Divisions. The Division also sponsored a session at which papers were delivered which were originally presented at the annual meeting of the American Society of Tool Engineers.

The scope of the many sessions was broad. They covered analysis; statistical methods; numerical control; new materials; studies of vibration, shock, and stress; and human factors in engineering. In this short space it would be impossible to do justice to the quality of the presentations. For the Machine Design program at a glance, see the "Availability List," pp. 97–101.

Maintenance and Plant Engineering. The Maintenance and Plant Engineering Division, the Society's youngest, has within its scope: management, control, analysis, and corrective action related to maintenance problems; design of equipment to facilitate maintenance and reduce costs; design and installation of additions or alterations to buildings, equipment, or facilities; provision and maintenance of utility services and salvage; and disposal of obsolete or scrap equipment.

At the Division's one session this year, a management control center to facilitate work planning, productivity measurement, and improve over-all maintenance was described. Also presented was a study of specialized refractories for maintenance purposes.

The Division was also cosponsor of sessions held jointly with the Lubrication and Management Divisions.

Management. The transition from engineer to administrator continues to hold the attention of management sessions, and this year a three-section panel was devoted to the subject. Speakers outlined reasons why more engineers are not singled out for administrative posts, the value of engineering experience in the performance of administrative tasks, and the development from an engineer to administrator.

Human engineering and the collection of data for human factors research are receiving greater recognition, as are new techniques of electronic data processing. Another new management technique, system simulation, was described.

Materials Handling. Solutions of materials-handling problems become increasingly important as production methods improve and production increases. At sessions of the Materials Handling Division, the latest approaches to materials handling were discussed. Use of elementary statistics provided a materials-handling analyses tool as did some new concepts in systems engineering of materials-handling operations.

Two specific papers treated the influence of size on rate of gravity flow of spherical particles and engineering for solids bulk containers.

Suggestions were presented on the economics of lift-truck replacement based on a two-year study of actual maintenance-cost histories.

British materials-handling methods were reported with particular referehce to problems encountered in machine shops, automotive, and cement plants.

Petroleum. Significant among the contributions of the Petroleum Division was a paper describing the "H-Iron" process. The process in combination with electric steelmaking furnaces provides a challenge to the combination of blast furnace and open-hearth furnace as a route to ingot steel. Oil and natural gas will provide the hydrogen for the new process. See pp. 27–30 in this issue.

Storage is a constant concern in the industry. Papers presented dealt with design of storage tanks to avoid brittle fracture and with the hazards associated with storage of liquefied petroleum gas.

Design and analysis of welded pressure-vessel skirt supports were also described.

Process Industries. Interest in the Process Industries Division sessions this year was concentrated in two areas—air conditioning and air pollution. Air conditioning for the new Social Security Building was described and a system of air conditioning for a room containing electronic computers was outlined. See pp. 43–45 in this issue.

In connection with air pollution, much attention was given to incinerators at a session held jointly with the Fuels Division. Wastes incineration, available quantities and utilization of heat from incineration, and air pollution resulting from incineration were treated. Metals for high-temperature applica-

tion in incinerator design were noted and the properties of available refractories for incinerators were discussed.

Other papers treated atmospheric gas-fired infrared heaters for processing applications; power heat balance considerations in design and operation of industrial plants; and the compacting process—a method of particle agglomeration.

Production Engineering. Production engineers are striving to increase the production and efficiency of manufacturing methods. Papers presented at Production Engineering Sessions witness this fact.

Plastic forming of metals—between rolls and by forging and extrusion—was the subject of a group of papers. Other papers dealt with the improvement of machining operations through studies of machinability. Increased attention is being directed toward machine-tool vibrations. The application of analytical techniques to operational problems is rapidly increasing in an effort to improve the efficiency of industrial operations. Recent improvements in shop techniques were also reported.

Railroad. Work in the railroad industry has been directed toward modernization of diesel locomotives and railroad cars through the use of the most recent engineering developments. At sessions of the Railroad Division these many developments were reported in the annual report of progress in railway mechanical engineering for 1957–1958. Developments in railroad motive power and rolling stock in the United States and abroad were reviewed. Among the specific subjects treated were glass-fiber banding of traction-motor armatures; a review of the development of draft gears; and a review of some recent advances in lubrication of railroad-car journal bearings.

Rubber and Plastics. Emphasis at rubber and plastics sessions continues to be placed on new materials and new information on old materials. This year "Delrin" acetal resin and room-temperature vulcanizing silicone rubber were among the materials considered. Significant new information on epoxy resins and their application as adhesives and applications of solid polyurethane was also reported.

Research papers on the physical and chemical behavior of rubber and plastics materials assumed an important position on the program.

Engineering studies related to fabrication and use of rubber and plastic materials also received considerable attention. Several papers dealt with plastics in combination with other materials. Problems associated with design and specifications of plastics were discussed. Among these were papers dealing with the relation of basic molecular parameters to service performance; the significance of physical-test methods in interpreting design properties of plastics; and the problem of translating laboratory design data into production practice.

Textile Engineering. The textile industry continues to make strides toward improved products and more efficient production methods. Sessions of the Textile Engineering Division discussed such items as a shuttleless loom which can produce a single sheet of fabric in widths ranging from 36 to 64 in. at speeds ranging from 250 picks per minute on narrow fabrics to 200 picks per minute.

The machine and the ideas that go into the development of nonwoven materials were also given in some detail.

Knitted fabrics and knitting machines were described, and methods of inspection and quality control of such machines were noted.

Safety. Activities of the Safety Division necessarily overlap those of other divisions and sessions this year were held jointly with the Nuclear Engineering, Production Engineering, and Machine Design Divisions.

Nuclear engineering is perhaps attended by the greatest potential hazards, and interest in safety ranks high among the concerns of the division. Studies of nuclear accidents in fast power reactors, experience with reactor operation and reactor safeguards, and fuel element instability were among the subjects covered. Risk evaluation in locating nuclear power plants and modifications, improvements, and simplifications of environmental reactor hazard evaluations were treated.

Also discussed under the heading of safety were human factors in machine design and medicine, philosophy, and management.

Professional Practice. The title of this session might well have been, "Do it yourself." For it was here that engineers sought, within their own precincts, to upgrade their professional status through registration and establish a better working relation with the segment of the public that "buys" their services.

Fundamentally, registration of professional engineers, it was pointed out, is a manifestation of the police power of each individual state or territory; and it was the engineering profession itself that requested such regulation. Wyoming adopted the first engineering registration law in 1907. The first Model Law was written by ASCE in 1913. Today we have registration laws in 54 of our states and territories.

A comparison of the several registration laws shows wide variation in requirements including age, education, experience, and examination. While the day of uniform standards in the registration laws is still far in the future, much has been accomplished since 1907. ECPD curriculums are specified as standard in 41 laws; 47 require written examinations; and 39 require at least four years of experience after graduation. The Certificate of Qualification issued by the National Bureau of Engineering Registration is recognized by 35 states. These similarities tend to make multiple registration by the individual less burdensome.

NCSBEE has called a meeting to be held early in 1959 to review the Model Law so that it may be brought into phase with the current desires of the profession. This revision and the raising of standards, it is hoped, will make multiple registration a relatively simple matter.

To operate an effective medium-sized consulting engineer's office requires organization and control. While the internal organization depends on the type of work carried on, the owners or partners must define their organization so that the staff knows in detail their areas of operation and responsibility, and new personnel may quickly grasp the structure of the firm. A good, solid manual is a great help. Each individual should report to one person only. The organization must be kept flexible so that peaks and valleys can be handled as evenly as possible; here proper organization in clerical and nontechnical sections is just as important as in the drafting room. Try to make each staff member feel he is an integral and proper component part of the organization. "Teach him his responsibilities and treat him as an individual human being—it pays!"

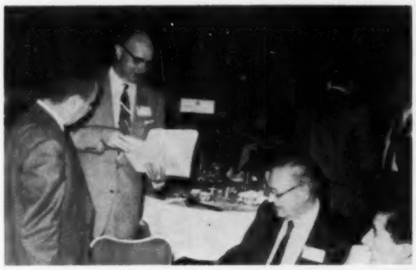
Training is lacking in the schools and colleges, it was noted. Too little is known about a consulting engineer's work. Thus training is often the job of the consulting engineer himself. A training program is important for juniors. Teach them technical advancement, appreciation of the work of other divisions in the firm, necessity for co-ordination, client handling, and finally, the over-all art of the business.

Use an efficient cost-control system. Have an incentive system amongst the staff. Keep an eye on public relations—here there are no rules, but technical articles published in professional journals help people to get to know you.

TECHNICAL SESSIONS

Breakfast: Authors and Chairmen only

Chairman Rohsenow, *left*, and Vice-Chairman Woolard: "Now, if no one forgot his slides . . ."



Authors' breakfast: It's all there, in the Chairman's folder

Glenn Fryling: "A black-board doesn't answer back."

Boiler Feedwater Studies. Standing, *left to right,* C. M. Loucks, W. A. Keilbaugh, E. B. Morris, D. E. Noll, F. J. Pocock. Seated, *left to right,* L. D. Betz and R. A. Lorenzin.

Nuclear Session. Seated, *left to right:* R. R. Tarrice, D. S. Ballantine, K. P. Johnson, W. I. Linlor, W. J. Frank. Standing, *left to right,* Chairman W. H. Donnelly and Vice-Chairman J. Duffy.

Lubrication Session. Standing room only

H. J. Rose: "The forms in which sulphur exists in coal . . ."

Education. Mechanical Engineering is the art and science of converting design concepts into working "hardware" which can be manufactured and sold at a profit. This was the gist of an answer given to the question, "What is the Profession of Mechanical Engineering?" posed during the joint Education-ASEE session.

It was further stated that mechanical engineering lies near the middle of the main stream of all engineering activity. It is essential to almost every industry and to every phase of technology—either directly, or through the related industrial complex which provides the necessary components and systems. It is this tremendous scope of the applications of mechanical engineering which gives this profession its strength, and which also leads to haziness as to its exact nature and the desirable educational preparation for it.

The fact that mechanical engineers may apply their art and science in every industry and in every phase of technology does not justify the conclusion that mechanical engineering is an all-encompassing profession under which all other branches fall. Mechanical engineers participate in the design of nuclear reactors, and the ASME gives attention to nuclear engineering in its publications, but this does not mean that nuclear engineering is merely a branch of mechanical engineering, or even that it has any natural affinity with the latter.

Confusion of the core activity characteristic of mechanical engineering probably presents no real problem to the practitioners of the profession, but it has misled the schools preparing students for this profession, and has resulted in an unfortunate haziness about educational goals and criteria. It is the opinion of many deans that mechanical-engineering departments in many schools have lost contact with the main thread of the profession—both through attention to applications in mature industries on the one hand, and through an unbalanced attention to certain engineering sciences on the other—and that a redefinition of the nature and scope of the profession is a desirable prelude to a discussion of the educational programs.

Luncheons and Dinners

President's Luncheon

ASME Past-President E. G. Bailey was toastmaster at the President's Luncheon, at which outgoing ASME President James N. Landis delivered the Presidential address (see pp. 25-26), on "The Importance of Local Engineering Councils for Engineering Unity." He reviewed some of the points that had been mentioned in the Sunday evening discussion on unification, particularly the proposal for an American Engineering Association whose name would have the same recognition for the public as the American Medical Association and the American Bar Association; pointing out that some advocate unification in one society, others favor federation. He stated that there is already a great deal of unified action.

Mrs. Robert W. Worley spoke briefly of the Woman's Auxiliary of which she is president. Like the well-known label, she stated, the Auxiliary is "not good if detached." It is not an independent woman's club, but functions only when it is serving the broader interests of ASME. The scholarship program of the group has grown greatly with 38 loans this year, compared with 9 last year, and a total of 45 loans outstanding.

The Worcester Reed Warner Medal was presented to Harold J. Rose, and the Melville Prize Medal to Thomas P. Goodman. The Blackall Machine Tool and Gage Award could not be presented in person since the teaching duties of the recipients kept them in England. Certificates were presented to the retiring Members of Council and to the 1958 ASME Lecturers. See "ASME Honors Engineers" (pp. 68–73).

Tribute was paid to the years of loyal distinguished service by D. C. A. Bosworth who is retiring as assistant secretary and controller. He has been a member of the staff since 1936. Mrs. Bosworth received a complete silver coffee service, and a volume of letters of appreciation from his colleagues and friends was presented to Mr. Bosworth.

Fuels-Power Luncheon

"A Reappraisal of Nuclear Power and the Effect of and on Our Fossil-Fuel Resources and Their Development" was made by Philip Sporn, Hon. Mem. ASME, and president of the American Electric Power Company. He stated that a harder look at all the problems involved to effect the transition to nuclear power and concentration on research and development will lead to a sound break-through on the type of reactor needed.

Mr. Sporn stated that the facts point to the use of conventional fuels for the next decade at least, and even in underdeveloped countries it may be better to start with conventional plants at this stage of nuclear development.

England, after concentrating on nuclear plants, is now embarrassed by an inventory of 15 million tons of surplus coal principally of the type best suited for power generation. This has occurred in spite of cutting back marginal mines and reducing the work week. The critical fuel situation in Western Europe is also easing and will permit more nuclear research and development there.

The U. S. has led in the variety, volume, and scope of nuclear-power developments. In spite of the fact that 40 million kw of the 360-million-kw total capacity to be added in this country in the next decade will be nuclear and 25 million kw hydroelectric, 50 million tons of coal will be needed for U. S. expansion in a single year.

To fully exploit our fossil-fuel resources, which will be important until nuclear power is developed enough to assume its share of the fuel requirements, much research is needed. Beneficiation can do much to improve the natural product, and transportation cost must be lowered. Underground gasification must be perfected and many metallurgical problems need to be solved.

If we are to maintain the same living standards during the next 25 years, Mr. Sporn stated, there will be a heavy dependence on the development of conventional-fuel technology.

Joseph C. McCabe, chairman of the Fuels Division, and editor of *Combustion*, presided at the luncheon. The ASME George Westinghouse Medal was presented to Frederick P. Fairchild, and the Prime Movers Committee Award was presented to Vivian F. Estcourt. See "ASME Honors Engineers" (pp. 68–73).

Machine Design Luncheon and Thurston Lecture

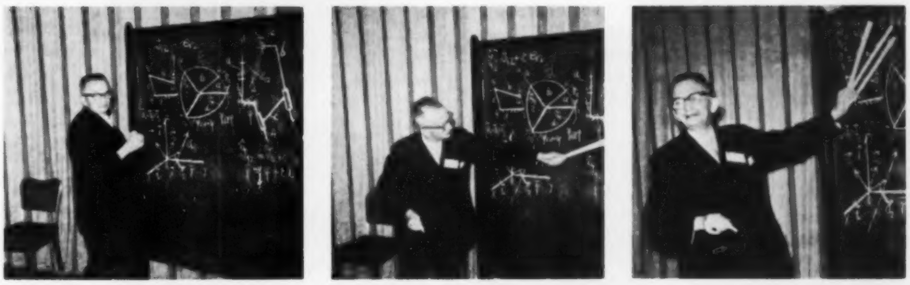
The Statler's top-floor "Penn Top Center," scene of the Machine Design Luncheon and the Thurston Lecture, looks down on the North River. Just before the luncheon, a great liner moved slowly upriver toward a West Side pier. Members of the division, watching through the French windows, could find symbolism in the incoming ship, since the Thurston lecturer was to bring them a report on the state of their technology in Europe.

The lecturer was Rudolph A. Beyer, Professor of Mechanical Engineering,

LUNCHEONS AND DINNERS

W. E. Boveri, 1958 Towne Lecturer, gives Dr. L. M. Gilbreth data on conditions in Switzerland before Management Luncheon

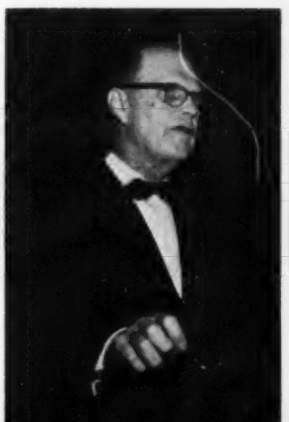
Prof. R. A. Beyer, 1958 Thurston Lecturer, gives a step-by-step report on recent research in mechanisms in Europe and in the United States



Mr. and Mrs. D. C. A. Bosworth receive mementoes from ASME on his retirement as controller and assistant secretary from C. E. Davies, secretary-emeritus

Philip Sporn reappraises nuclear power in a talk before Fuels-Power Luncheon

"Engineering improvements have reduced oil-drilling cost," says E. V. Murphree, president, Esso Research and Engineering Company, at Petroleum Dinner



Left to *right*, new chairman W. E. Hammond, outgoing chairman S. P. Kezios, past-chairman Sigmund Kopp—at Heat Transfer Luncheon

Technical University, Munich, Germany. He had been on a four-month lecture tour of the United States, visiting industrial plants as well as technical colleges and universities. He had held a summer session at M.I.T., given a special course on three-dimensional mechanisms at Columbia, and taken part in conferences at Purdue and at the University of Alabama.

In its 33-year history, the Thurston Lecture has been presented 11 times previously, the last being in 1950, when Theodore von Karman addressed the Society on the subject of high-speed vehicles.

The Thurston Lecture is in honor of Robert Henry Thurston, first President of the ASME and far-seeing leader in science and engineering. It gives an opportunity for a leader in pure and applied science to reveal some new development, new research, or new application of science that offers promise of engineering and industrial use. Dr. Beyer's subject was "Recent Research in Mechanisms in Europe and the U. S. A."

More than 80 engineers attended the luncheon. H. S. Sizer of Brown & Sharpe, outgoing chairman of the Machine Design Division, presided. Among those introduced was C. W. Besserer of the Space Technology Laboratories, Ramo-Wooldridge Corporation, Los Angeles, Calif., who takes over as Chairman for 1959.

Granger Davenport, chief engineer of Gould & Eberhardt, Inc., Irvington, N. J., who has been honored by election to the grade of Fellow of the ASME, received a certificate attesting to his new membership. Presentation was made by T. R. Rideout, consulting engineer of Portchester, N. Y.

In the Thurston Lecture, Professor Beyer listed six objectives which, in his opinion, have been the goals of investigations in the systematics of mechanisms since World War II. He then presented his report on which of these goals have already, or at least in part, been reached during the past decade. He concluded that the research on the synthesis of plane mechanisms has been successful, both in Europe and the U. S., and proposed that the new methods, now taught in Germany, be taught in American universities.

As to synthesis of spherical mechanisms with intersecting axes, and three-dimensional mechanisms with skew axes, a new theory has contributed, at least paving the way for continuing research.

"We have taken up an abundance of problems," he said. "The problem now is to bring about practical applications. This is what must be examined by you gentlemen."

Applied Mechanics Dinner

The dinner on Tuesday evening at the Men's Faculty Club, Columbia University, was the occasion for honoring three outstanding men in the field of applied mechanics. The names of Theodore von Karman, Arpad L. Nadai, and Sir Geoffrey I. Taylor hardly need introduction, and the conferring of the Timoshenko Medal was in recognition of their distinguished contributions to the field. (See "ASME Honors Engineers," pp. 68–73.)

N. J. Hoff of Stanford University, in reviewing the career of Dr. von Karman, said it was one so filled with achievements and honors that it would take months to enumerate them. He touched on some of the famous von Karman theories—the von Karman vortex street, the Karman-Trefftz theory of slender wings in subsonic range, and the theory of oscillating airfoil. Not content with retiring, von Karman at the age of 70, said Dr. Hoff, worked on the theory of combustion and aerothermochemistry, and at the age of 77 entered the field of magnetohydrodynamics. It would be impossible, the speaker remarked, to talk about von Karman without mentioning some of the von Karman stories—particularly the one about the street-car conductor in a European city who was unable to start his car. Von Karman, it seems, was using the side of the trolley as a blackboard.

The Timoshenko Medal was presented to von Karman for his contributions to the mechanics of fluids and solids, particularly those leading to major advancements in aeronautics.

The next recipient of the Medal, Arpad L. Nadai, Fellow ASME, was introduced by Miklos Hetényi, past chairman of the Division. In the past years the contributions to mathematics and physical sciences, said Dr. Hetényi, were made by outstanding engineers such as Dr. Nadai. His stature in mechanics was firmly established at the University of Göttingen when he produced "Theory of Elastic Plates" during the 1920's, the speaker continued. Later as consulting engineer at Westinghouse Research Laboratories Dr. Nadai inspired and led many young engineers. His scope of accomplishments, said Dr. Hetényi, extends from research papers on applied mechanics to patents on mechanical equipment and the writing of the volume on "Flow and Fracture of Solids." The speaker concluded by paying tribute to Dr. Nadai as researcher, author, and scientist.

Dr. Nadai received the Timoshenko Medal for his contributions to the theory of elastic plates and the flow and fracture of solid bodies.

Sir Geoffrey I. Taylor, the third Medalist, is a scientist who is known for constantly departing from the beaten track, said Norman Goodyear of Stanford University. The dislocation theory and the workings of solids and fluids were among the accomplishments reviewed by Professor Goodyear. A lifelong habit of exploring new ideas didn't end at the age of 65, and Sir Geoffrey has become a symbol of new developments in classical mechanics, Professor Goodyear said in conclusion.

Sir Geoffrey was presented with the Timoshenko Medal for his many fundamental contributions to a better understanding of the mechanics of solids and fluids.

Glenn B. Warren, President ASME, presented the Medals to the three recipients.

Walter Ramberg, U. S. National Bureau of Standards, Washington, D. C., retiring chairman, received a certificate of appreciation in testimony of his services in advancing the profession and as chairman of the Division.

Petroleum Dinner

The only real offset against inflation-swollen costs in oil and chemical-refining operation lies in new design features and more efficient processes, said Eger V. Murphree, president of Esso Research and Engineering Company, addressing the Petroleum dinner audience.

Mr. Murphree said a detailed study made by Esso showed that better design and improved processes had cut new refinery-equipment costs by about five per cent a year.

"This has more than taken care of the forces of inflation so that over the years, on an actual dollar basis, the cost of new equipment to do a given job has decreased," he stated.

Discussing the engineer in oil research, he also credited engineering improvements with reducing oil-drilling costs by two or three per cent a year, which "has just about taken care of inflation."

Mr. Murphree reported that new techniques may make it possible to double the nation's petroleum reserves, present and potential. These same methods may be useful, he added, when it becomes economical to develop oil shale and tar sands deposits.

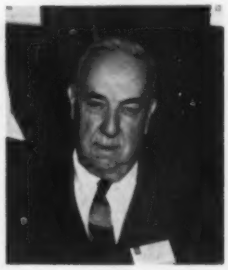
He pointed out that the water-flooding method of oil recovery, now commonly practiced, produces an average of 50 per cent more oil than can be obtained with primary methods. The injection of rich gas into reservoirs—another method—can give "very high recoveries" in

LUNCHEONS AND DINNERS

Prof. Harold A. Johnson, speaker at Heat Transfer Luncheon

"Research . . . can cure . . ." says K. R. Fox at Textile Engineering Luncheon

N. M. Mitchell, chairman, ASME Textile Engineering Division, at luncheon



Herman Schlichting of the Institut fur Stromungsmechanik, Technische Hochschule, Braunschweig, Germany

G. B. Warren, incoming president; J. W. Barker, past-president; J. N. Landis, outgoing president; at Members and Students Luncheon

Heat Transfer Luncheon: Professor Johnson's slides held the audience

Granger Davenport, *left*, receives certificate of Fellow ASME from T. R. Rideout at Machine Design Luncheon

certain cases and, according to laboratory data, is capable of 100 per cent recovery.

The underground combustion technique has aroused "considerable interest" and "looks interesting," he commented, but cautioned that more engineering work will be required before the method can be put on a "truly economic basis."

The packaging field was pinpointed as one in which engineers can make sizable contributions toward lower costs. He noted, as an example, that the cost of cans for motor oil is now a significant part of the total product cost.

Mr. Murphree estimated that American petroleum research now amounts to some $300 million a year and has been expanding at the average rate of around 12 per cent annually.

Some other statistics on the American oil industry included: Estimated investment is about $47.4 billion; employees number 1,600,000; consumption of oil products in the United States is at the rate of some 8,900,000 barrels a day; U. S. consumption represents about 56 per cent of the world total; and drilling expenditures in 1957 were around $4.4 billion.

H. H. Meredith, Jr., chairman, Petroleum Division, presided. J. N. Landis, ASME president, presented the certificate of Fellow grade in the Society to David B. Rossheim. Mr. Murphree, in the capacity of president and chairman of the fifth World Petroleum Congress, to be held in New York City, May 30–June 5, 1959, invited all petroleum engineers to participate and attend the sessions.

Heat Transfer Luncheon

The Heat Transfer Division held its luncheon on Wednesday, in the "Winter Garden" of the Sheraton-McAlpin, which was also the locale of the Division's heavy schedule of technical sessions. There, in the McAlpin's top-story ballroom, more than 90 engineers heard Harold A. Johnson, Professor of Mechanical Engineering at the University of California in Berkeley, tell of his round-the-world tour in which he contacted educators and scientists in 14 countries.

S. P. Kezios, Professor of Mechanical Engineering at the Illinois Institute of Technology and outgoing Chairman of the Division, presided at the luncheon. He announced that a new publication, the ***Journal of Heat Transfer***, had been approved. It will join the ***Journal of Basic Engineering***, ***Journal of Engineering for Industry***, ***Journal of Engineering for Power***, and ***Journal of Applied Mechanics*** as one of the Transactions publications of the ASME. Its first issue will appear in February, 1959.

The luncheon was the occasion for honoring Sigmund Kopp of Alco Products, whose long service to the ASME included his chairmanship of the Heat Transfer Division in 1957. Mr. Kopp received a certificate for his service to the Division.

Also introduced was W. E. Hammond, chief engineer of Air Preheater Corporation, Wellsville, N. Y., Chairman of the Division for 1959.

Professor Johnson's talk was a travelogue of visits made to research institutions in Japan, India, Egypt, and 11 Western European countries from October, 1957, to July, 1958. He showed color slides of his photographs, some of which showed the scientists and teachers he visited not only in their laboratories, but in their homes, with their families. He had taken many pictures of the cities of the Far East.

"The Taj Mahal," he said, "remains the world's most beautiful building." And then he reminded his audience of a fact which might be pondered by today's industrial designers as they motor home from their offices. The architect who designed the Taj Mahal for the Shah-Jahan was thereafter imprisoned, lest he design an even more beautiful building.

In the countries between Japan and Italy, Professor Johnson encountered little engineering activity. In Europe he found that all phases of heat-transfer and fluid-mechanics research were in progress, and, without exception, the research is done by technically competent staffs in well-equipped laboratories. He has prepared an itinerary of his visits in which he details his findings, listing heat-transfer research institutions in the Far East and Western Europe, naming the engineers and scientists as well as their companies or institutions. The report is a "Who's Who" of heat-transfer engineering in noncommunist Europe and Asia.

"The postwar rebuilding," he said, "seems to be in a final stage, with every institution engaged in construction or modification of laboratory buildings and facilities, many nearing completion."

Although he found no scientific "breakthrough," he did find interesting developments in improved techniques, apparatus, and instruments.

Management Luncheon

"Life today resembles life in an ant hill," said Walter Boveri, president of the Brown Boveri Corporation of Switzerland, one of the world's leading manufacturers of gas-turbine engines. "The freedom man set out to gain by the conquest of matter becomes more and more an illusion because each further step he takes seems to lead him irrevocably into deeper servitude to his new masters: Technical progress and materialistic prosperity."

Mr. Boveri delivered the 1958 Henry Robinson Towne Lecture before the Management Luncheon audience on Wednesday, December 3. "I am happy to introduce Mr. Boveri to so large an audience and the audience to Mr. Boveri," said Dr. Lillian M. Gilbreth, Hon. Mem. ASME. Dr. Gilbreth, world-famous management consultant, briefly told about the Towne Lecture, which was established by ASME in 1925, to give its members an opportunity to hear an outstanding leader reveal his experiences relating to the scientific method in industry or business.

"The machines which man has created have progressed, but not man himself," said Mr. Boveri, describing the modern human being as nothing more than "a small cog in the soulless machinery of technical progress." Mr. Boveri called on the free world to climb out of "the witch's cauldron" in which it finds itself. "The final purpose of all research should never be technical progress, but exclusively and always the progress of man," he said, proposing the broad outlines of a plan by which the western world may reach this goal.

He proposed that governments here and in the rest of the free world form a group of "broad-minded, highly educated men vested with great authority in the field of education" to make "such alterations at all levels as to insure that the general mental development of the student is not lost sight of, while at the same time any specialized training can be carried on alongisde."

"Intellectual versatility is exclusively obtained by strict discipline of the brain, by endurance, and by deep independent thought, not only on specialized subjects, but on all the great riddles enveloping our life" noted Mr. Boveri. "Man must learn to seek, also through the arts, philosophy, and religion, the deeper meaning of life that can consist neither in technical achievements nor in the furtherance of purely materialistic aims," he said.

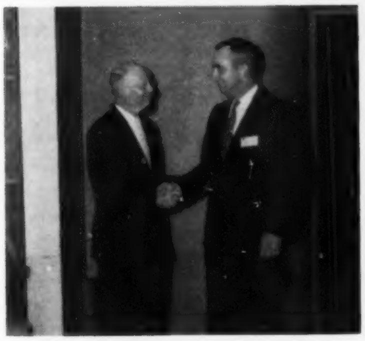
Robert G. Hess, chairman, Management Division, presided; he was also the recipient of a certificate of appreciation from the Society for his services as chairman of the Division. Allan Harvey, operating partner, Dasol Corporation, New York, N. Y., received the Management Paper Award for his paper, "Management and Engineering in the Age of Automation," published in the

HONORS AND AWARDS

Melville. President Landis presents Melville Prize Medal to T. P. Goodman at President's Luncheon

Timoshenko. T. von Karman receives the Timoshenko Medal from G. B. Warren at Applied Mechanics Dinner. . . N. J. Hoff, a witness

Prime Movers Committee Award goes to V. F. Estcourt, *center*. G. B. Warren and J. C. McCabe approve choice at Fuels-Power Luncheon.



Richards Memorial Award presented by Prof. D. S. Clark, *left*, to D. C. Burnham at Members and Students Luncheon

Westinghouse. F. P. Fairchild, *right*, ASME George Westinghouse Gold Medal recipient, receives President Warren's best wishes

Undergraduate Student Award to Robert E. Woolcott and **Charles T. Main Award** to Frank D. Sams at Members and Students Luncheon. H. D. Harkins, chairman, Board on Honors, expresses his approval.

May, 1958, issue of MECHANICAL ENGINEERING, pp. 67–69. R. B. Lea was called on to present H. F. Vickers with the certificate marking promotion to Fellow grade in the Society. President Landis presented the Towne Lecture Certificate to Mr. Boveri.

Hydraulic Old Timers Stag Dinner

In spite of the title, there were no Sally Rand effects at the Hydraulic Old Timers Stag Dinner. Several hundred "old timers" in the division, who happened to average close to sixty, enjoyed a good buffet supper, reminisced, and renewed acquaintances. The record age was 92, and several members were in their eighties. Although there were no formal speeches there was plenty of homespun humor.

G. Dugan Johnson, chairman of the ASME Hydraulic Division, and chief hydraulic engineer of the S. Morgan Smith Company, York, Pa., presided. Guest of honor was one of the pioneers in boundary-layer theory, Herman Schlichting of the Institut für Strömungsmechanik, Technische Hochschule, Braunschweig, Germany.

Members and Students Luncheon

The star-studded event of the Annual Meeting is the Members and Students Luncheon. The achievements of young engineers are rewarded and acclaimed by engineers—from students just starting on the long road to the elder statesmen of the profession. It is, indeed, an inspiring affair.

J. N. Landis, the outgoing President of ASME, presided. It was his sad duty to open the proceedings with the announcement of the death of a past-president and great member of ASME, Harold V. Coes. Mr. Landis then introduced a large group of engineering students who had come to the Annual Meeting with their Faculty Adviser from Wayne State University.

The incoming ASME President, Glenn B. Warren, was introduced. "Preparation for engineering life is a long job," said Mr. Warren. He compared engineering at the time he was graduated from school to the present, pointing out that due to cumulative knowledge, the cold war, an exploding technology, now would certainly be a challenging time to be starting out. Professional societies help men to face and master their problems, he said, noting ASME's contributions to profession and country. He concluded his brief talk by saying that half of the outstanding original thinking has been contributed by men not yet 34 years of age—perhaps, because they were not stymied "by not knowing what you can't do."

Prof. David S. Clark of Purdue representing Carroll M. Leonard of Oklahoma A&M, president of Pi Tau Sigma, was called on to present the recipients of the Pi Tau Sigma, national honorary mechanical-engineering fraternity awards. They are: Donald C. Burnham, winner of the Richards Memorial Award for outstanding achievement within 20 to 25 years after graduation; and Allison K. Simons, the Pi Tau Sigma Gold Medal Award for outstanding achievement within ten years after graduation.

H. Drake Harkins, chairman of the ASME Board on Honors, was then called on to present the recipients of the Charles T. Main Award and the Undergraduate Student Award. Frank D. Sams, son of James H. Sams, vice-president, ASME Region IV, and Mrs. Sams, won the Charles T. Main Award for his paper, "Student Development of Professional Engineering Attitudes and Ethics." Robert E. Woolcott won the Undergraduate Student Award for his paper, "The Measurement of the Components of Front End Alignment."

Before presenting the Old Guard Prize to Harry Hollingshaus for his paper on "Correlation of Mechanical Properties of Bone With Radiation Damage," three stalwart "Old Guards" were introduced. They are: William A. Shoudy, Richard A. North, and Walter L. Betts. Mr. Hollingshaus' paper, chosen from among all the papers presented by Student Members at Regional Conferences throughout the Country, was judged the winning paper at the 1958 ASME Semi-Annual Meeting. Mr. Hollingshaus presented his paper which will be published in a subsequent issue of MECHANICAL ENGINEERING.

In the principal address at the luncheon, Joseph W. Barker, The Roy V. Wright Lecturer, said that "the qualified voters of this country have abdicated their democratic birthright when only some 55 per cent went to the polls on November fourth."

Dr. Barker, past-president ASME, said we have come to care so little for this priceless heritage that only a minority of the eligible voters even take time to go to the polls. This is serious enough, but there is still a worse canker at the roots of the problem—how the slates of candidates are selected.

He urged that engineers not only cast their ballots at election, but take an active part in the selection of the slate of candidates and in the formulating of platforms. He decried "our self-satisfaction and materialistic complacency." His lecture will be published in an early issue of MECHANICAL ENGINEERING.

At the conclusion of his talk, Dr. Barker urged his audience to obtain from the local NAM staff units a packet of political seminar material entitled "How to Become Effective in the Party of Your Choice."

President Warren presented the Roy V. Wright Lecture Certificate to Dr. Barker.

Annual Banquet

More than 1100 members of the Society and their guests attended the Annual Banquet. They witnessed the conferral of its highest honor—honorary membership; and the presentation of the ASME Medal and the Daniel Guggenheim Medal. They also heard Dr. John H. Furbay, director, Air World Education, Trans World Airlines, Inc., speak on "The Shape of Things to Come."

James N. Landis, outgoing President and Fellow ASME, acted as toastmaster. The evening's program was opened with the invocation given by Carl J. Eckhardt, Fellow ASME, professor of mechanical engineering, University of Texas, Austin, Texas.

"This annual banquet is the dramatic climax of the 78th Annual Meeting of ASME devoted to 'New Frontiers in Engineering—Key to Mankind's Progress,'" said Mr. Landis to signal the beginning of the procession of events which make this a memorable evening in ASME annals. He added that these new frontiers have been discussed in papers presented by nearly 700 authors in 400 papers, grouped in 130 technical sessions. Examples of these frontiers have been exhibited in the National Exposition of Power and Mechanical Engineering, sponsored by ASME, and held in the New York Coliseum concurrently with the Annual Meeting.

Distinguished guests from sister professional societies were introduced by Secretary Schier. Mr. Landis then expressed regrets for the absence of the American Rocket Society, ASME affiliate, at the meeting, adding that, in the future, it may be possible to relate the two meetings so that the members of each society will have the opportunity to participate in both meetings without undue inconvenience.

"The meeting witnesses another change," said Mr. Landis, "dictated by the growth of our profession—the decentralization of the presentation of Society honors. At last year's banquet our Meetings Committee and your Council came to the realization that the growth in the number of honors presented at our meeting was such as to make the pro-

HONORS AND AWARDS

Timoshenko.
Sir Geoffrey I. Taylor, former Yarrow Research Professor of the Royal Society, Cambridge, England, addresses the Applied Mechanics Dinner audience on accepting the Timoshenko Medal. S. P. Timoshenko, Hon. Mem. ASME, for whom the medal was named, is shown seated, *right.*

Worcester Reed Warner.
H. J. Rose, *right,* winner of the Worcester Reed Warner Medal, is greeted by President Landis

Old Guard.
W. A. Shoudy, welcomes Harry Hollingshaus, winner of Old Guard Prize, to Members and Students Luncheon

Pi Tau Sigma
Gold Medal Award goes to A. K. Simons, *left.* Professor Clark makes the presentation at Members and Students Luncheon.

Timoshenko.
A. L. Nadai accepts the Timoshenko Medal at the Applied Mechanics Dinner. Miklos Hetenyi, *center,* A. M. Wahl look on.

ceedings of the annual banquet somewhat tedious. As a first step, the Meetings Committee recommended, and the Council heartily concurred, that a decentralization in the presentation of honors would add luster to their presentation, and also do more honor to the recipients."

"Other changes have also taken place in this banquet," he pointed out. "With the growth of our Society, which has now reached nearly 57,000 members, the number attaining the completion of 50 years or more of membership and eligibility, therefore, to wear a special fifty-year badge, has grown into a sizable list. These new fifty-year members live in many parts of the country and many are unable to attend the Annual Meeting here in New York. It has been our decision to have their fifty-year badges presented to them at Section meetings throughout the country." Mr. Landis asked the members of 50 years or more to rise. They were greeted with resounding applause.

Old Guard. The members of the "Old Guard," 35-year members, conduct a program of professional development of students and young members of the Society. Under the leadership of W. A. Shoudy and Richard North, the Old Guard arranged for the winners from each of the 12 Regional Student Conferences to meet at the Semi-Annual Meeting in Detroit, Mich., and compete for a single national Old Guard prize. The winner this year and guest of the Old Guard was Harry Hollingshaus who presented his paper at the Members and Students Luncheon earlier in the day. Other guests of the Old Guard included a number of Student Members from various Student Sections. All rose to be recognized by the audience.

New Council Members—the President. The new members of the Council were introduced. They include: Richard G. Folsom of Troy, N. Y., and Arthur M. Perrin of Fairview, N. J., directors; and vice-presidents, Charles H. Coogan, Jr., of Storrs, Conn.; Thomas J. Dolan of Urbana, Ill.; Harold Grasse of Kansas City, Mo.; Gordon R. Hahn of New York, N. Y.; and John W. Little of Birmingham, Ala., who was unable to attend the meeting.

The outgoing President introduced the incoming President, Glenn B. Warren. Mr. Warren, 78th President of ASME, was greeted with a standing round of applause. He thanked the members for this great honor and pledged his efforts to the good of the Society and its members for the year of his office. Mr. Warren then presented Mr. Landis with the diamond-studded Membership pin—mark of an ASME President.

Honors. Now it was time for the honors—the greatest reward for accomplishment, the recognition of an engineer's work by his fellow engineers.

H. Drake Harkins, chairman of the ASME Board on Honors was called on to present the honorees. First called was Wilbur H. Armacost, Fellow ASME, to receive the 1958 ASME Medal; then the eminent engineers whose careers and contributions to engineering make them eligible for Honorary Membership in the Society. They are: John Blizard, Fellow ASME; Howard Coonley, Affiliate, ASME; James E. Gleason, Mem. ASME, who was represented by his nephew; and Ernest L. Robinson, Fellow ASME.

John H. Parkin, chairman of the Daniel Guggenheim Medal Board of Award, presented William Littlewood, Mem. ASME, the 1958 recipient of the Daniel Guggenheim Medal. (Biographical sketches of the men who were honored by the Society at the Annual Meeting may be found in the article "ASME Honors Engineers," on pp. 68–73 in this issue.)

J. H. Furbay — Banquet Speaker. "Technology is not enough," said Dr. J. H. Furbay, director of Air World Education for Trans World Airlines. Tracing the advance of culture and commerce—"you don't have one without the other"—from the canoe-paddling "explorer" to the discovery of the wheel that took man into the hinterlands, he said, travel had carried culture and commerce to but one third of the world by the beginning of the 20th century. The airplane, he called, the amazing fact of the 20th century. For the first time all barriers were lowered—the whole world was opened to trade and the exchange of ideas.

With the opening of these doors comes a serious responsibility for those meaning to use them. A glaring fact has become evident: Americans must improve themselves. Technology is not enough in this big new world. The day is twenty-four hours long in the one third of the world we call "civilized"—it is just as long in the other two thirds. We meet with these people and they know more about us than we do about them.

We are specialists with knowledge concentrated in an extremely limited area, he said. We who would aid in the development of the vast two thirds of the world now open to us must know something of their geography, sociology, language—they have a culture and we would do well to know something about it; technology is not enough.

Example: High-pressure selling. They won't have any of it.

Wood Industries Luncheon

At the Wood Industries Luncheon on Friday, Teel Williams, executive director of the Mahogany Association, Inc., told of the renewal of interest in mahogany which had resulted from the application of marketing techniques. Sales of mahogany, which had previously reigned supreme among cabinet woods for several centuries, began to fall off about five years ago.

By applying modern techniques, materials, and highly developed skills in wood finishing, mahogany was made to conform more with current demand in the furniture market. As a result 50 of the most prominent manufacturers of the country will have showings in mahogany at the Chicago show in January, 1959.

He stated that although wood products can be redesigned to compete with cheap output in other materials, the association was convinced that the industry "must grade up not trade down to the level of substitutes." A rickety piece of furniture, a poor product, is an open invitation to the substitutes.

"The future of all wood industries depends upon the knowledge and skills of our woodworking engineers in producing superior wood products," Mr. Williams stated.

Textile Engineering Luncheon

Research was described as a "form of preventive and progressive medicine" by Kenneth R. Fox, Mem. ASME, vice-president, Fabric Research Laboratories, Inc., Dedham, Mass. Dr. Fox spoke on the importance of research in the textile industry at the Textile Engineering Luncheon.

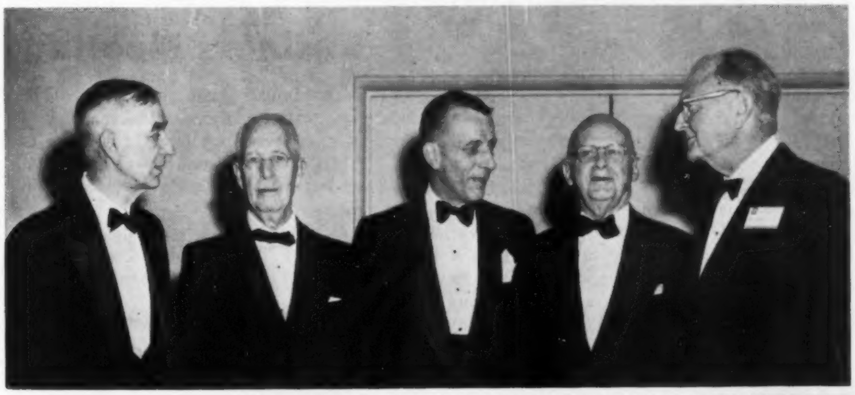
Referring to what research can do both for the "sick and the healthy patient," Dr. Fox noted that "only the human body and the federal government are more complicated than the textile industry" and that "many of the industry's parts are presently sick."

Within this general framework, Dr. Fox discussed four broad areas of research and pleaded for an industry-wide co-operative effort to make possible major advances and to create a generally healthy textile economy. The four areas of research were: Motivational, economic, market, and technical.

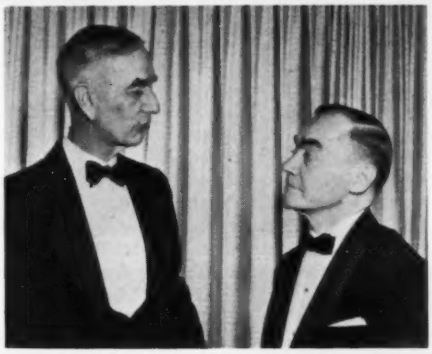
Dr. Fox cited the advantages that could accrue to the entire industry from fundamental research on the chemistry, physics, and engineering of basic textile materials; major studies in fields such as wash and wear; a new and fresh look at production concepts and methods, particularly directed to achieving a better return on sales.

ANNUAL BANQUET

Honorary Membership conferred on four. *Left to right,* E. L. Robinson, John Blizard, L. C. Gleason who accepted for his uncle J. E. Gleason, and Howard Coonley. H. D. Harkins, chairman of Board on Honors, congratulates honorees.



E. L. Robinson, *left,* chats with W. H. Armacost, recipient of the 1958 ASME Medal

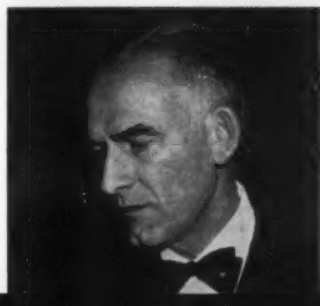


Aviation Progress Report. J. H. Furbay, director, TWA Air World Education, *left,* exchanges information with William Littlewood, *center,* recipient of Daniel Guggenheim Medal, and J. C. Hunsaker, Hon. Mem. ASME and noted aeronautical engineer

Glenn B. Warren, incoming ASME President, faces the future with a smile

J. N. Landis, outgoing president, recalls some of the year's events

O. B. Schier, II, happily refutes the yarn, "the first year is the roughest"



K. F. Tupper, president of EIC, a distinguished visitor from Canada

College Reunions

Wednesday was College Reunion day for 20 schools—Georgia Tech chose Friday. From noon through the day the meeting took on a campus air, old school ties were worn, and old friends joined new friends to "remember when. . ."

Colonel R. P. Kline, Deputy Atlantic District Engineer, recently returned from Pakistan, addressed the University of California group at a luncheon held at Toots Shor's. The Cooper Union alumni inspected the mechanical engineering laboratories in the Hewitt Building and then to dinner at a "campus" restaurant. Cornell University grads joined The Cornell Society of Engineers at the Engineers' Club for cocktails and dinner, and a talk by A. H. Mogensen, director of "Work Simplification." The Georgia Tech alumni attended the Fall dinner meeting of the Georgia Tech Club of New York held at the Reeves Sound Studios. Georgia Tech president, Edwin D. Harrison was guest speaker of the evening. Michigan State University alumni got their feet under the table at the White Turkey to enjoy roast beef and a talk by J. D. Ryder about "The MSU International Program." All the College of Engineering graduates of Ohio State University were invited to meet the new dean, Harold A. Bolz, at the White Turkey. After dinner Dean Bolz told his audience, "Here's what's happening in your college." President Ernest Weber spoke informally at the Polytechnic Institute of Brooklyn's mechanical-engineering alumni dinner. Graduates of Rensselaer Polytechnic Institute welcomed President Richard G. Folsom, who was guest at their luncheon held at the Engineers' Club. The members of the Worcester Polytechnic Institute alumni in the New York and New Jersey area held a reunion dinner at the New York University Club.

Brown Engineering Association held its annual reunion dinner at the New York Brown Club. Carnegie Institute of Technology alumni was host to a cocktail party at the Architectural League. The reunion of the alumni of the College of the City of New York was held at the Hotel Governor-Clinton. The New York-Iowa State Alumni Association sponsored a cocktail party meeting at the Engineers' Club. A luncheon at the Engineers' Club was where the University of Michigan alumni met. The alumni of the University of Missouri, University of North Dakota, and Yale University met separately, place unknown. The Pratt Institute alumni gathered at dinner at Keen's Chop House, and Stevens Institute of Technology had a reunion at the Stevens Metropolitan Club. Tufts University had a luncheon reunion at the Zeta Psi Club.

Inspection Trips

Where did you go? What did you see? Was it interesting?

They went out to see the $30 million New York International Airport at Idlewild and saw the Arrival and Airline Wing Buildings central structures in the facility's 655-acre terminal city project, and inspected the central heating and refrigeration plant. This glass-enclosed showplace houses the cooling and heating system that serves the International Arrival Building, the Airline Wing Building, and eventually all of the Unit Terminals. The system is not only the largest single absorption-type air-conditioning system yet built, but also is the first in which a high-temperature, hot-water system has been used for cooling as well as heating. It's fair to say as many jets touch down and take off at Idlewild in a day as at any airport in the world.

They went out to Linden, N. J., and saw the new generating station operated by Public Service Electric and Gas Company, one of the company's chain of eight generating stations now in service or under construction. This station has an initial capacity of 450,000 kw in two units and is unique in its extremely high efficiency which can only be obtained by utilizing the heat in the steam in industrial processes following its passage through the turbines. The steam, up to a maximum of 1,000,550 lb per hr, is supplied to the Bayway Refinery of Esso Standard Oil Company, which adjoins the station. In return for the steam, Esso furnishes fuel oil and water. Does this sound a little like barter?

They visited the site of the new United Engineering Center and the present Engineering Societies Building. This will help roll in the contributions. . .if anything will.

They went aboard the *SS Independence*. This 30,000 ton American Export liner was built in 1951 and plies the "sun lane" route to the Mediterranean—while the ship is fully air conditioned, the day this party went aboard heat was more welcome. Viewing the business side of the ship's bridge, fire-control facilities, and galley areas did not close anyone's eyes to the luxurious appointments in the public rooms or some of the staterooms.

They saw the Jacob Ruppert brewery which occupies four city blocks and where 1600 people are employed. The plant was recently completely modernized—the old buildings were adapted to modern manufacturing. The feature of this tour included processes completely automatic and controlled by central control boards, modern materials handling with complete palletization, and quick coolers.

Was it interesting? Must have been: All trips were oversubscribed.

Business Meeting

The annual Business Meeting of The American Society of Mechanical Engineers convened on Dec. 1, 1958, at the Hotel Statler Hilton, New York, N. Y., with James N. Landis, President, presiding.

O. B. Schier, II, secretary of ASME, presented high lights of the Annual Report of the Council, Boards, and Committees.

Annual Report High Lights. Mr. Schier reported that during the past year membership of ASME reached new highs, soaring to 56,546, including 8450 student members.

In addition, the Society's recognition of an era of intensive specialization resulted in a record number of national conferences and meetings. These were attended by over 20,000 members and others interested in learning of and discussing new developments in dozens of fields of engineering.

Great strides were made toward erection of the United Engineering Center. Assets available to United Engineering Trustees, which will own and operate the new Center, passed the $6 million mark. The four Founder Societies, including ASME, which had shared the responsibility of joint ownership of UET, were joined during the year by a fifth society, The American Institute of Chemical Engineers. AIChE will also be housed in the new Center.

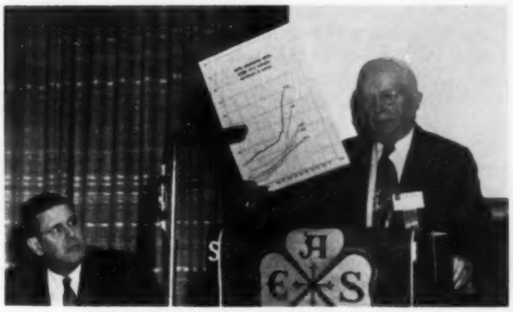
Periodicals and other literature published by the Society were restyled and reorganized in order to take advantage of modern editorial and production techniques and to make ASME publications more valuable as well as more attractive to their readers.

Work previously under the jurisdiction of the Board of Education and Professional Status was reorganized and, by action of the Council in June, 1958, a new Board of Education and a separate Committee on Professional Practice were created and have begun operating.

Financially, the Society completed another year of increased activity to

THE ROVING CAMERA

W. F. Ryan speaking, O. B. Schier, II listening. "This requires vigorous work by our Vice-Presidents."

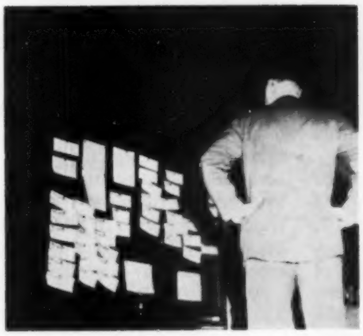


W. F. Thompson: "The ASME Member Gifts Campaign has been slow in getting started."

Two for the Fuels-Power Luncheon. How about a tour of the S.S. Constitution?

Registration. Name, address, company affiliation. Please print.

We have your reservation. Now, we have one on the tenth floor...



Please call: Urgent... Lost: One brief case, initials M. B.

Five rewarding days: Then .... it's over.

members with a balanced budget, it was reported by Fenton B. Turck, chairman of the Finance Committee.

Both reports—Council and Finance—make up Section 2 of this issue of MECHANICAL ENGINEERING.

The Secretary reported for the record that a total of 6596 new members were admitted to the Society, during the year, due to the effective improvement and benefits realized from the new student member program, and that 271 were lost through death.

Constitutional Amendments. President Landis then called on Clarence Campbell to give a report on the proposed amendments to the Constitution and By-Laws. Mr. Campbell is Chairman of the Constitution and By-Laws Committee.

Mr. Campbell's report dealt with the proposal to amend constitutional Article C5 concerning fees and dues to eliminate the $10 transfer fee for transfer from associate to either full member or affiliate member. This amendment was proposed by the Regional Delegates Conference and acted upon favorably as a proposal to be put before the members for member ballot by the Constitution and By-Laws Committee and the Council.

Continuing, Mr. Campbell said that we have had for two years a deferred constitutional amendment. Its purpose was to change the designation of "Student Branches" to "Student Sections." That was deferred awaiting a companion amendment which would better justify the expenditure involved in an all-member ballot. It is therefore proposed to incorporate that amendment at the same time in so far as the Constitution is concerned. This involves an amendment of Article C4, Section 7, and C12, Section 1.

On a motion from the floor it was approved that the foregoing amendments be put to the membership for ballot.

Also, on a motion from the floor, the acts and transactions of the Society and its Council during the year from Oct. 1, 1957, to Sept. 30, 1958, were approved.

The secretary then read the report of the Tellers for the election of officers, R. W. Cockrell, E. P. Lange, and John de S. Coutinho, and the President called on each newly elected officer to stand.

The officers elected are: Richard G. Folsom and Arthur M. Perrin, Directors; Charles H. Coogan, Jr. (Region I), Gordon R. Hahn (Region II), John W. Little (Region IV), Thomas J. Dolan (Region VI), Harold Grasse (Region VIII), Vice-Presidents; and Glenn B. Warren, President.

Biographical sketches of the newly elected officers were published in MECHANICAL ENGINEERING, August, 1958, pp. 126–130.

United Engineering Center. As a special feature of the Business Meeting, Willis Thompson, ASME representative on United Engineering Trustees, Inc., Building Committee, briefed the members on the current status and future plans for this project. (See UET Report, pp. 106–108, in this issue.)

In particular, he cited the Member Gifts Campaign which he noted has been slow in getting started. By Nov. 21, 1958, it had reached only 39.8 per cent of its goal. Compared to some of our sister societies, he said, ASME's part in the membership campaign has been particularly slow in getting under way and the total of our subscriptions to date is far from satisfactory.

Thus far only 4218 ASME members, which is about 9 per cent of the total, contributed $249,764—31 per cent of our goal, at an average contribution of a bit less than $60, Mr. Thompson reported. To attain our goal at least 10,000 additional members must be reached.

We in UET are not ready to believe that a majority of the members of the Founder Societies lack the interest necessary to support their profession, he declared. Neither do we believe that they are not aware of the need for larger and more efficient quarters for the societies. Neither do we believe that their membership depends only on how much they can get out of their society with little or no regard for its survival.

On the other hand, Mr. Thompson continued, we do believe that local fund-raising efforts in most sections have not been too effective. We know that some members are still waiting for the fund-raising committee of their section to contact them. We also know that some members believe we can somehow construct a new Engineering Center without their donations. So far we have been fortunate in overcoming that which has appeared to be the impossible, but, Mr. Thompson warned, don't expect a miracle.

William F. Ryan, chairman of the ASME Member Gifts Campaign, in his report, indicated that nine ASME Sections haven't turned in one single bit of information about what they are doing or what they expect to get. That, he said, requires vigorous treatment by our regional vice-presidents who supervise the working committees for member giving. It would be unfortunate not to mention a few outstanding sections: Waterbury, with 168 per cent of its quota from 17 per cent of its members; Hudson Mohawk (Schenectady), 110 per cent of its quota from 39 per cent of its members; Atlanta, 108 per cent of its quota from 11 per cent of its members; Cincinnati with 121 per cent—(their goal now is 200 per cent), from 52 per cent of its members. No other section has done that, said Mr. Ryan, although Fort Wayne is up to nearly 50 per cent with 96 per cent of its quota.

Committees in Charge

ASME Meetings come under the general supervision of the Meetings Committee.

The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the host section—in this case, the ASME Metropolitan Section.

In grateful acknowledgment, the many committees, whose efforts contributed so substantially to the success of the 1958 Annual Meeting follow:

Meetings Committee: Glenn R. Fryling, *chairman;* W. B. Wilkins; Arthur M. Gompf; H. N. Muller, Jr.; Kenneth L. Selby; Robert E. Jonelis; Bruce M. Bailey.

Board on Honors: H. Drake Harkins, *chairman;* Harold V. Coes (deceased); Martin Goland; J. Stanley Morehouse; Abbott L. Penniman, Jr.; Lewis K. Sillcox; and W. Weaver Smith.

Metropolitan Section: George B. Thom, *chairman;* H. H. Johnson, *secretary;* Robert W. Cockrell, *treasurer;* Miss M. O. England, *assistant secretary, assistant treasurer;* Robert E. Abbott; James T. Costigan; John de S. Coutinho; Frank G. Feeley, Jr.; Glenn R. Fryling; Frederick H. Linley, Jr.; and Arthur M. Perrin, *Ex-Officio.*

General Arrangements Committee: Arthur M. Perrin, *chairman.*

Technical Events Committee: U. A. Rothermel, *chairman;* W. Kowalsky; M. Dallen; W. Cameron; J. Predale; R. E. Abbott.

Inspection Trips Committee: John Weiss, *chairman.*

Banquet Committee: Henry C. Wheaton, *chairman;* Herman H. Johnson, *vice-chairman;* Arthur M. Perrin; Edlow S. Bance; and Justus T. Vollbrecht.

Women's Program: Mrs. Robert W. Worley, *honorary chairman;* Mrs. Gordon R. Hahn, *chairman, Metropolitan Section;* Mrs. Erik Oberg, *general chairman;* Mrs. William H. Byrne, *vice-chairman;* Mrs. John C. Gibb, *vice-chairman;* and Mrs. William Hausmann, *vice-chairman.*

1958 ASME Annual Meeting Papers

Availability List

THE papers in this list are available in separate copy form until October 1, 1959. Please order only by paper number; otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Papers are priced at 40 cents each to members; 80 cents to nonmembers.

Applied Mechanics

58—A-1 Analysis of the Thermoelectric Effects by Methods of Irreversible Thermodynamics, by G. N. HATSOPOULOS and J. H. KEENAN

58—A-2 The Synthesis of a Four-Bar Mechanism for Prescribed Extreme Values of the Angular Velocity of the Driven Link, by J. HIRSCHHORN

58—A-3 Unsteady Laminar Boundary Layers in an Incompressible Stagnation Flow, by KWANG-TZU YANG

58—A-4 Ducted Fan Design Theory, by C. G. VAN NIEKERK

58—A-5 The Effect of Spin Upon the Rolling Motion of an Elastic Sphere on a Plane, by K. L. JOHNSON

58—A-6 Natural Forcing Functions in Nonlinear Systems, by T. J. HARVEY

58—A-7 The Effect of a Tangential Contact Force Upon the Rolling Motion of an Elastic Sphere on a Plane, by K. L. JOHNSON

58—A-8 Forced Torsional Vibration of Systems With Distributed Mass and Internal and External Damping, by K. E. BISSHOPP

58—A-9 The Effect of Product of Inertia Coupling on the Natural Frequencies of a Rigid Body on Resilient Supports, by C. E. CREDE

58—A-10 Stress Distribution and Plastic Deformation in Rotating Cylinders of Strain-Hardening Material, by E. A. DAVIS and F. M. CONNELLY

58—A-11 Plastic Stress-Strain Relationships—Some Experiments on the Effect of Loading Path and Loading History, by S. S. GILL and J. PARKER

58—A-12 Ductile Fracture Instability in Shear, by F. A. MCCLINTOCK

58—A-13 Transient Film Condensation, by E. M. SPARROW and R. SIEGEL

58—A-14 Axially Symmetric Buckling of Shallow Spherical Shells Under External Pressure, by E. L. REISS

58—A-15 The Wedge Under a Concentrated Couple: A Paradox in the Two-Dimensional Theory of Elasticity, by ELI STERNBERG and W. T. KOITER

58—A-16 Elastic, Plastic Stresses in Free Plate With Periodically Varying Surface Temperature, by HALIL YÜKSEL

58—A-17 Analytical Design of Disk Cams and Three-Dimensional Cams by Independent Position Equations, by F. H. RAVEN

58—A-18 A Fresh Test of the Epstein Equations for Cylinders, by E. H. KENNARD

58—A-19 Laminar Flow in a Uniformly Porous Channel, by F. M. WHITE, JR., B. F. BARFIELD, and M. J. GOGLIA

58—A-20 Carrying Capacity of Plates of Arbitrary Shape and Variable Fixity Under a Concentrated Load, by M. ZAID

58—A-21 Transient and Residual Stresses in Heat-Treated Cylinders, by J. H. WEINER and J. V. HUDDLESTON

58—A-22 The Stresses in a Thick Cylinder Having a Square Hole Under Concentrated Loading, by MASAICHIRO SEIKA

58—A-23 A Simple Approach to an Approximate Two-Dimensional Cascade Theory, by M. J. SCHILHANSL

58—A-24 The End Problem of Cylinders, by G. HORVAY and J. A. MIRABAL

58—A-25 The Strain-Energy Expression for Thin Elastic Shells, by J. H. HAYWOOD and L. B. WILSON

58—A-26 Limit Analysis of Symmetrically Loaded Thin Shells of Revolution, by D. C. DRUCKER and R. T. SHIELD

58—A-27 Stresses and Deflections in an Elastically Restrained Circular Plate Under Uniform Normal Loading Over a Segment, by W. A. BASSALI and M. NASSIF

58—A-28 Normal Vibrations of a Uniform Plate Carrying Any Number of Finite Masses, by W. F. STOKEY and C. F. ZOROWSKI

58—A-30 The Effect of Turbulence on Slider-Bearing Lubrication, by YE TSANG CHOU and EDWARD SAIBEL

58—A-31 A Definition of Stable Inelastic Material, by D. C. DRUCKER

58—A-32 Theory of Flight of the Sounding Rocket, by V. C. LIU

58—A-33 On Influence Coefficients and Nonlinearity for Thin Shells of Revolution, by E. REISSNER

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58—A-138 Observations on the Angle Relationships in Metal Cutting, by D. M. Eggleston, R. Herzog and E. G. Thomsen
58—A-139 Some Observations on the Shearing Process in Metal Cutting, by S. Kobayashi and E. G. Thomsen
58—A-140 Approximate Solutions to a Problem of Press Forging, by S. Kobayashi and E. G. Thomsen
58—A-154 Theory and Experiment of Press Forging Axisymmetric Parts of Aluminum and Lead, by S. Kobayashi, R. Herzog, J. T. Lapsley, Jr., and E. G. Thomsen
58—A-157 The Wear of Abrasives in Grinding, by G. J. Goepfert and Josephine L. Williams
58—A-161 Study of Machinability of Metals, by H. Takeyama and E. Usui
58—A-180 The Effects of Recent Industrial-Diamond Developments, by C. L. Fanning
58—A-182 Employment Stabilization, by J. F. Magee
58—A-183 Development and Application of Trepanning, by A. C. Heidenreich
58—A-189 Self-Excited Vibrations in Metal Cutting, by N. H. Cook
58—A-223 The Efficient Use of Welded Steel in Machine Design, by Omer Blodgett
58—A-226 Abrasive Finishing of Hard Gears, by H. Pelphrey

Railroad

58—A-173 Glass-Fiber Banding of Traction-Motor Armatures, by E. C. Appleby
58—A-185 Low Carbon-Intermediate Manganese Constructional Steel Castings, by R. D. Engquist
58—A-186 The Economics of Reclamation of EMD 567 Engine Cylinders With Porous Chrome, by J. M. A. Van Der Horst and Russell Pyles
58—A-218 Progress in Railway Mechanical Engineering 1957-1958, Report of Committee RR-6 Survey
58—A-229 Review of the Development of Draft Gears, by N. T. Olsen
58—A-265 Variables in Train Resistance, by W. M. Keller
58—A-266 A Review of Some Recent Advances in Lubrication of Railway Car Journal Plain Bearings, by R. F. Meeker and D. C. McGahey

Rubber and Plastics

58—A-259 Designing With "Delrin" Acetal Resin, by W. C. Warriner
58—A-285 Applications of Solid Polyurethane, by K. H. Grim

ASME Special Publications

The following publications contain papers presented at the 1958 Annual Meeting, but not available separately. Copies may be obtained from ASME Order Department, 29 West 39th Street, New York 18, N. Y.

Mechanical Impedance Methods for Vibration Problems.

This volume includes precise definitions and shows how impedance methods apply to lumped and continuous systems of simple and moderate complexity, reviews measurement techniques, demonstrates the power of digital computers by comparing the calculated and measured characteristics of a highly symmetrical system of moderate complexity, gives measured values of typical structures of large size and high complexity, discusses the importance of the impedance in influencing shock and vibration spectra measured in field service, shows how to apply impedance methods to the calculation of vibration insolator effectiveness, treats impedance of some disordered systems, and illustrates how impedance methods may be used to find the response to random excitation. Price $5.50; $4.40 to ASME members.

Gas Turbine Progress Report

Specifically covered in this 1958 Report are gas-turbine materials, the advances in turbine cooling, fuels and the technical problems associated with them, cycle components, and the trend toward simplicity in their arrangement, the compound piston-and-turbine engines, aviation gas-turbine developments, rocket turbines, gas turbine in the automotive field, gas-turbine locomotive advances the gas turbine and the free-piston gas turbine in the marine field, industrial and central station applications of the gas turbine, and the nuclear gas-turbine plant and areas of development. Price $5; $4 to ASME members.

Diaphragm Characteristics, Design, and Terminology

This manual defines a diaphragm and its performance characteristics, describes methods of measuring and representing them, shows how they are related and used, describes and illustrates the effects of design details and manufacturing methods on the characteristics. In the appendixes, the terms and notations used are defined, the equipment and methods of testing described, the applications of the diaphragms classified, and equations given. Prices $3.75; $3 to ASME Members.

Includes Letters from Readers on Miscellaneous Subjects

COMMENTS ON PAPERS

Professionalism

To the Editor:

At a recent local ASME meeting which I attended there was much discussion from the floor concerning the professional status of engineers. I would say that most of the concern in this matter was evidenced by the younger members present.

The discussion sounded familiar, covering the same points and material which I used to discuss with my fellow engineers, ten or more years ago. I got to thinking about what has happened to my own attitude over these past ten or so years which has resulted in a cessation of discussions on this subject. For what they may be worth, I have put down a few thoughts.

In general, I would say that the younger members of our profession and perhaps the younger members of any profession are overly concerned with such aspects as professional recognition. This concern leads to groups of engineers joining together to weep on each other's shoulders over the lack of recognition of Engineering as a profession. In some cases this commiseration leads to the establishment of a special organization which hopes to attain by legislation what has not been attained by individual efforts.

In the last analysis, professionalism is a state of mind; and such things cannot be altered by legislation. No professional society can attain prestige and respect for its members who, by their own approach, interests, and efforts, do not attain respect and prestige for themselves.

The Professional joins a society for advancement of the profession, the setting of standards, and the education of posterity. The nonprofessional joins a society for what it can do for him.

The Professional wins respect for his society—does not depend upon the society to gain respect for him.

What we believe about a person is still determined 99 per cent by our personal contact with him, his reputation, what he says, how he acts—what he does—not by the fact that some society dubs him a professional. We go to a physician because of his reputation and as a result of recommendations from his (living) patients. If we feel that a physician is incompetent we don't go back to him in spite of the fact that he is a member of the AMA.

Professionalism is judged on a person-to-person basis and its nonexistence is recognized by persons outside of the profession almost as easily (and sometimes sooner) than by those within the same profession. This is particularly true in the case of situations or problems which are solved by representatives of many professions. When the Engineer's contribution is presented simultaneously with those of physicians, lawyers, businessmen, and so forth, the attitudes and approaches of the various individuals are easily compared.

If Engineers feel their profession suffers a lack of appreciation as a profession by the public and other professions, I would venture to say that it is the result of as many battles lost in School Board Meetings, Zoning Commissions, Church Meetings, Boy Scout Councils, and Civic Leagues as over drawing boards and boards of directors' meetings. Worse, most of these battles are lost by default. How can a contestant win if he doesn't show up?

It is only by the perspective sharpened by association with the problems of other people and other professions and occupations that the engineer gains the understanding of the broader purposes for which he and his profession are striving and directs or apportions his professional efforts accordingly.

The engineer will gain recognition as a Professional Engineer only as he attains recognition as a Professional Citizen.

No professional society can gain recognition for a class of individuals by legislation. Each individual must gain this for himself. When we complain that the public doesn't understand us and ask for organizations to present our case to the public, we have lost sight of the fact that we, individually, have not carried our share of personal responsibility in informing and guiding the public. It is not now, it never was, and it never will be the duty of the public to recognize the Professional.

It is the duty of the Professional to recognize the public! It is only when this fact is accepted by the Engineer that the public will accept the Engineer as a Professional.

J. B. Nichols.[1]

[1] Manager, Advanced Planning, Hiller Aircraft Corporation, Palo Alto, Calif. Assoc. Mem. ASME.

BOOKS RECEIVED IN LIBRARY

The Use of Analogs and Analog Computers in Heat Transfer
By M. Tribus. Publication No. 100 of the Oklahoma State University Engineering Experiment Station. 1958, The Experiment Station, Stillwater, Okla. 83 p., $8^1/_2 \times 11$ in., paper. \$2.50. Following a discussion of analog computers in general, author covers the use of analogs in the solution of transient heat exchanger problems, the Otis method for solving the ablation problem, and heat conduction with variable thermal properties. An analysis of errors and sources of errors in analogs concludes the study.

Automatic Process Control
By Donald P. Eckman. 1958, John Wiley & Sons, Inc., New York, N. Y. 368 p., $6 \times 9^1/_4$ in., bound. \$9. Automatic control principles are presented with emphasis on block diagrams and frequency techniques in process control. Beginning with process and controller char-

acteristics, the book continues with the closed loop in automatic control, measuring and controlling elements, process instrumentation, sinusoidal analysis, and stability analysis.

The Calculation of Load and Torque in Hot Flat Rolling

By P. M. Cook & A. W. McCrum. 1958, The British Iron and Steel Research Association, London, England. 109 p., 13 × 12¹/₄ in., spiral binding. £3. Through recent work with high-speed compression testing machines, stress-strain data have become available for different types of steels at temperatures and deformation rates applicable to the hot-rolling process. The present volume presents a series of graphs for the determination of load and torque, utilizing these data. The graphs are preceded by a brief explanatory introduction.

A Comprehensive Bibliography on Operations Research

Operations Research Group, Case Institute of Technology. 1958, John Wiley & Sons, Inc., New York, N. Y. 188 p., 8¹/₂ × 11¹/₂ in., bound. $6.50. A listing of 3000 books, articles, reports, and proceedings intended for operations researchers. Material closely related to this field is included. An alphabetical index to all of the citations is followed by bibliographies dealing with special fields of interest such as sequencing, theory, site location, layout, etc. The main bibliography covers references through 1956; a supplement contains titles published in 1957.

Conference on Extremely High Temperatures

Edited by Heinz Fisher and Lawrence C. Mansur. 1958, John Wiley and Sons, Inc., New York, N. Y. 258 p., 8¹/₂ × 11¹/₄ in., bound. $9.75. Represents a summary of the knowledge underlying commercial or usable thermonuclear reactions. Particular emphasis is placed on high temperatures as they relate to the propulsion fields. Covers the production of extremely high temperatures, methods of temperature measurement such as optical radiation, plasma analysis, and applications. The conference, held in 1958, was sponsored by the Electronics Research Directorate, Air Force Cambridge Research Center.

Constitution of Binary Alloys

By Max Hansen. Second Edition, prepared with the co-operation of Kurt Anderko. 1958, McGraw-Hill Book Company, New York, N.Y. 1305 p., 6¹/₄ × 9¹/₄ in., bound. $32.50. An extensive reference volume, revised and considerably enlarged from a 1936 German edition, is now available in English for the first time. It represents a comprehensive survey of 1334 binary alloy systems, and includes 717 phase diagrams. Diagrams are presented linearly in atomic per cent. Crystallographic data are covered systematically and includes the symmetry of the intermediate phases and lattice spacings.

Creativeness for Engineers

By Donald S. Pearson. 1958, published by the Author, Pennsylvania State University, University Park, Pa. 122 p., 5¹/₂ × 8³/₄ in., bound. $3.75. Consists of two parts, the first of which discusses a philosophy to stimulate creativeness and to motivate the potentially creative person. The second part deals with a creative approach aimed at producing a more effective reaction between the individual and his effort. Appendixes provide means for practical application of these principles.

Engineering Economy

By Clarence E. Bullinger. Third Edition. 1958, McGraw-Hill Book Company, New York, N. Y. 379 p., 6¹/₄ × 9¹/₄ in., bound. $7. Deals with the various stages of planning from the inception of an idea to its development and design phases, including the design and operation of a factory to produce the product. This edition brings cost data up to date and introduces new operations research procedures, particularly the concept of "models" and "criteria." The effect of state and federal taxes on engineering projects is treated for the first time.

LIBRARY SERVICES

ENGINEERING Societies Library books may be borrowed by mail by ASME Members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply a photoprint or a microfilm copy of any items in its collection. Address inquiries to Ralph H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

Engineering Materials

By the Committee on Engineering Materials. 1958, Pitman Publishing Corporation, New York, N. Y. 616 p., 6¹/₄ × 9¹/₄ in., bound. $8.50. This volume is divided into three parts, the first of which deals with various kinds of aggregates, cements, concretes, bituminous materials, stone, timbers, glass, and plastics. The second part deals with properties of metals and alloys including alloy steels, wrought iron, cast iron, malleable cast iron, and nonferrous metals and alloys. It concludes with the preservation and testing of materials. The authors are a group of engineering-materials professors in American universities.

Experimental Designs in Industry

Edited by Victor Chew. 1958, John Wiley & Sons, Inc., New York, N. Y. 268 p., 7³/₄ × 11¹/₄ in., bound. $6. The first section reviews classical designs and provides an account of factorial experimental designs in both complete and incomplete blocks. In addition it gives a detailed description of regression analyses. The second section provides actual illustrations of the use of incomplete blocks, fractional factorial and response surface designs in industrial research. The book consists of papers delivered at a 1956 symposium at North Carolina State College, sponsored by the Air Force Office of Scientific Research.

Finite Queuing Tables

By L. G. Peck and R. N. Hazelwood. 1958, John Wiley & Sons, Inc., New York, N. Y. 210 p., 8³/₄ × 11¹/₄ in., bound. $8.50. Provides tables useful in the solution of queuing problems such as communication channel requirements for finite populations, machine loading determinations, and estimating equipment and manpower requirements. A preface gives information and examples illustrating the use of the tables in specific applications. The second volume in the series "Publications in Operations Research" sponsored by the Operations Research Society of America.

Fluorocarbons

By Merritt A. Rudner. 1958, Reinhold Publishing Corp., New York, N. Y. 238 p., 5¹/₄ × 8³/₄ in., bound. $5.75. Information is provided on the history, unusual properties, chemistry, methods of manufacture, and applications of the fluorocarbons. Electrical, mechanical, and chemical applications are discussed in detail, and an indication is given of possible future uses.

Foundations of Information Theory

By Amiel Feinstein. 1958, McGraw-Hill Book Company, Inc., New York, N. Y. 137 p., 6¹/₄ × 9¹/₄ in., bound. $6.50. An analysis of the mathematical theory of information. The author discusses the discrete channel with and without memory; the coding theorem for discrete channels without memory; the semi-continuous channel without memory; the binary symmetric channel.

Geschichte der Kokereitechnik

By Franz M. Ress. 1957, Verlag Glückauf, GmbH, Essen, Germany. 672 p., 8¹/₄ × 12 in., bound. 148 DM. The first two thirds of this thorough and comprehensive history of the coke industry deals with the period up to 1900. The remainder is devoted to modern developments. The result of extensive research in the archives of the industry, the book presents a factual account of all significant activities, illustrated by hundreds of diagrams, photographs, and portraits of equipment, places, and personalities. Well-documented as to sources, the volume also includes full name and subject-indexes.

A History of Technology

Volume IV: The Industrial Revolution. Edited by Charles Singer & others. 1958, Oxford University Press, New York, N. Y. 728 p., 7¹/₄ × 10 in., bound. $26.90. A detailed account of the vise of modern industrialism. Six aspects are discussed: primary production; forms of energy; manufacture; static engineering; communications; scientific basis of technology. The volume is superbly printed and illustrated.

International Conference on Soil Mechanics and Foundation Engineering

Proceedings of the Fourth Conference, London, 1957, Volume 3. Butterworths Scientific Publications, London, England; Interscience Publishers, Inc., New York, N. Y. 291 p., 8³/₄ × 11¹/₄ in., bound. $79.50, 3-volume set. The present volume contains the official records of the meeting, extensive discussions on the papers, and an author index to contributors. This completes this important publication covering practically all phases of soil mechanics and foundation engineering.

Jet Propulsion

By Walter J. Hesse. 1958, Pitman Publishing Corporation, New York, N. Y. 567 p., 6 × 9¹/₄ in., bound. $9.75. The author attempts to explain concepts from the fundamental engineering laws rather than from an equation standpoint. Emphasis is given to the aerothermodynamics of gas systems, and topics discussed include the diffuser, nozzle, Fanno line, isothermal, normal shock, and oblique shock flow. The flow through each engine component and the components themselves are discussed, as is the combined performance characteristics of engines and air frames.

Lehrbuch des Walzwerksbaus

By A. I. Zelikow. 1957, VEB Verlag Technik, Berlin, Germany. 538 p., 7 × 9¹/₂ in., bound. 36 DM. This comprehensive treatise on rolling mill construction is a German translation from the Russian. It covers the general subject of roll stands and roll trains, the forces involved, the separate parts and auxiliary equipment of roll stands and their construction, roll drives, and special purpose installations.

Current Engineering Events, News, and Comment

E. S. NEWMAN
News Editor

THE ROUNDUP

U. S. Mission Studies Engineering Education in USSR

ENGINEERING education of sound quality is effectively integrated into the planned economy of the USSR. This was one of the major observations of a recent mission of U. S. engineering educators who spent three weeks of study and inspection in the USSR.

Members of the mission called particular attention to the dynamic character of Russian engineering education, the continuous process of re-evaluation affecting it, and the ability of this controlled system to adjust to the inevitable variations in personal capabilities at both the student and faculty level.

The mission was sponsored by the American Society for Engineering Education and the National Science Foundation with the co-operation of Engineers Council for Professional Development. Its chairman was Dr. Frederick C. Lindvall, Mem. ASME, chairman of the Division of Engineering at California Institute of Technology; Prof. Newman A. Hall, Mem. ASME, head of the Department of Mechanical Engineering at Yale University, was secretary.

The U. S. delegation visited 25 teaching and research institutions in Moscow, Leningrad, Kuibyshev, and Frunze.

This mission was initiated by the Department of State under an agreement with the USSR for the exchange of scientific and cultural delegations. A comparable Soviet educational mission is expected to visit the United States in February, 1959.

According to a preliminary report, the whole economy of the USSR is integrated into a broad plan administered by an agency known as GOSPLAN. The formulation of the portion of the master plan related to engineering education is the responsibility of the Ministry of Higher Education.

A long-range plan covering a period normally of five years (currently seven years) is formulated first. Each year this master plan is modified to take into account the accomplishments actually achieved in the previous year. The plan considers the needs of the whole Soviet Union in the light of: (*a*) The expansion of industrial plant capacity, (*b*) the need for replacements, and the replacement by professional people of non-professional personnel not adequately trained.

The seven-year plan now being formulated contemplates that an average of 350,000 graduates in all professional fields (engineering, science, medicine, languages, and so on) will complete their training each year. This is an increase of 40 per cent over the average of the past seven years, but in engineering it is proposed that the increase shall be 90 per cent.

The master plan specifies: (*a*) The number who may enter the institutions of higher education, (*b*) the number who may train for each field of specialization, (*c*) the quota of each specific institution for each specialty, and (*d*) the jobs which will be available at graduation.

Such planning demands that each student (at present upon graduation from the ten-year school at the age of 17 or 18) must choose irrevocably a narrow field of specialization when he applies for admission to college. Alternatively, he may postpone this decision by temporarily entering industry; under changes now contemplated, this period of industrial experience may become obligatory. The rules allow the student to apply for only one field of specialization in one institute in a given year. Furthermore, he commits himself to work in the particular phase of industry for which the course is designed. If he fails to secure admission in a severe competition (but one which varies in its severity with the field and institution), he may not apply for higher education for another year.

While the student makes a commitment as to his field, the goals and objectives of the plan may be changed by the State from time to time. Thus specific curriculums at certain schools may be eliminated. The students then enrolled in such curriculums will be shifted to a similar specialty in which additional manpower is needed. They may, however, be allowed additional time, up to six months, to adjust to the change.

As indicated above, changes in the program are now under consideration. These include: (*a*) Revision of the amount of industrial practice required, (*b*) broadening of the base of some curriculums, and (*c*) changing the number of students in specialties to fit the revised industrial program.

Tailored to Job

Since Soviet engineering education is planned to fulfill the specific needs of the state, it is tailored in considerable detail to the jobs to which the young engineer will be upon graduation. The curriculums are narrowly specialized in their objectives and prepare the students to be immediately useful to industry with a minimum of additional training. This results in dividing engineering into some 160 separate specialties such as mechanical engineer-automobile designer or mechanical engineer-automobile maintenance. This contrasts sharply with less than 20 fields accredited in the U. S., of which the great majority of students are included in about five fields.

The duration of the full-time day program is 5 or $5^1/_2$ years. The first two years are broadly based on mathematics and science. But from the day of his matriculation the student pursues a specialty. For the most part he meets, in lectures or laboratories, only with other students taking the same program. Textbook illustrations are selected to emphasize specific applications.

The last three years consist of increasingly specific courses, often built around design projects, industrial practice, and an elaborate diploma project requiring one semester of full-time work. These projects involve extensive detailed drawing and are intended to acquaint the student both with principles and prevailing practice in his specialty.

The young Soviet engineers are well grounded, and their best men are as good as any in the world. However, it appears to the delegation that many must be limited in their outlook by knowing little engineering outside their own narrow field.

Professional Standing

Nowhere is the engineer and scientist held in higher regard than in the USSR. Engineering students and practicing engineers are exempt from military service. Indeed, engineers and scientists are among the aristocracy of Soviet society. There is, therefore, strong motivation and social pressure to aspire to such careers.

An engineering education opens the door to positions of high rank. On the other hand, to achieve such positions without some type of diploma would appear virtually impossible. In general, the limit of achievement of the non-graduate in an industrial enterprise is the position of foreman, while this is considered the minimum position for a graduate.

A motivation factor not to be underestimated is the strong devotion to a system that greatly encourages education. Those who qualify for admission to an institution of higher learning need not be concerned because of a lack of financial resources. Grants are provided by the state to care for basic needs.

Keen Competition

A system that offers such unique advantages to the educated instills a strong desire for higher education in the youth of both sexes. Currently about one third of the total enrollment in the schools of engineering technology is comprised of girls. Competition for admission is keen. The planned economy provides one opportunity for every three to nine applicants, depending on the prestige of the institution and the importance attached to the specialty. Since students may make only one application for admission in a given year, the less able are motivated to apply for admission to a specialty in which there is a minimum of competition rather than to the specialty of their first choice.

As a result of these factors, a seriousness of purpose pervades the classroom and laboratory. This is clearly evident to the most casual observer. The students themselves have a genuine respect for intellectual achievement and disdain for the laggard. In this atmosphere, approximately 90 per cent of those who gain admission to the day schools complete diploma requirements and 50 per cent of those in evening and correspondence programs graduate.

It was also observed that the educational system is able to adapt itself not only to changing industrial needs but also to the wide ranges in human interest and ability.

Advanced Curriculums

Some 14 outstanding institutions offer more advanced and individualized curriculums. These institutions are given greater freedom in changing their curriculums from the prescribed pattern. Modifications of appreciable magnitude are usually approved by the Ministry with little delay. These institutions, as well as the stronger industrial groups and research institutes, are expected to provide leadership in changing programs to meet new scientific and engineering developments. It also appears that competition to enter these institutions is keener and that they attract the most able students from all over the USSR.

Observations

For several years there has been much expressed difference of opinion in the U.S. concerning the quality of technological education in the USSR. This mission has had the opportunity to observe classes in operation, to talk with teachers, and to examine curriculums. It is clearly evident that thorough, scientifically based programs of study are in operation.

Laboratory equipment is of good quality and in ample supply but varies appreciably between institutions. In addition, considerable imagination has been used in developing equipment to demonstrate basic principles. Textbooks appear to be in ample supply and carefully prepared. They are encyclopedic in nature and include much practical information in addition to the theory. Furthermore, an extensive background in mathematics is required to follow accurately much of the text material. It appears that the entering student knows as much mathematics and somewhat more physics and chemistry than college freshmen entering the better engineering schools in the U. S. A. The Soviet 5 and $5^1/_2$-year curriculums afford time to give a good theoretical background in addition to much practice with problems specifically related to the student's specialty. However, the members of the Mission agree that engineering education in the USSR cannot be compared realistically with that in the United States because it is tailored to quite a different system.

U. S. Mission studies engineering education in USSR. Front row, seated *left to right*, are: William L. Everitt, dean, college of engineering, University of Illinois; N. A. Hall, Mem. ASME, professor and chairman, mechanical engineering, Yale University; F. C. Lindvall, Mem. ASME, chairman, engineering, California Institute of Technology; W. T. Alexander, Mem. ASME, dean, engineering, Northeastern University. Back row, *left to right*, Ralph E. Fadum, head, civil-engineering department, North Carolina State College; Ralph A. Morgen, director, Purdue Research Foundation; Leon Trilling, associate professor, aeronautical engineering, Massachusetts Institute of Technology; Albert G. Guy, professor, metallurgical engineering, Purdue University.

1957-1958 UET Report Features—

United Engineering Center
Engineering Societies Library
The Engineering Foundation

The United Engineering Trustees, Inc., in its annual report for 1957-1958, fifty-fourth year of its operation, emphasized progress made in plans for the new United Engineering Center. The report was issued recently by UET President Walter J. Barrett. The following excerpts are from his report:

General. UET, as the joint corporate agency of the Founder Societies, is responsible for the administration of large trust funds for the advancement of the engineering arts and sciences. In furthering its Charter objectives, UET is now fully launched on a program of providing for the major national engineering societies a new national headquarters which fully and adequately can serve an expanding technology. When the present Engineering Societies Building was dedicated in 1907, the Founder Societies listed membership totaled 15,539. Today, the Founder Societies membership lists total more than 186,000 and are growing rapidly.

AIChE—Fifth Founder Society

Late in 1956, basis for admission of the American Institute of Chemical Engineers as a fifth Founder Society was approved by the governing bodies of the Founder Societies and AIChE. Subsequently, with crystallization of plans for the new Center, formal Founders', Supplemental, and Library Agreements were prepared and approved by the five governing bodies. By May 1, 1958, all agreements were signed by the Presidents of the five Societies and UET, and on that date the American Institute of Chemical Engineers became a fifth Founder Society in UET.

United Engineering Center

Site. By the beginning of the present fiscal year, UET had acquired title to 34,000 sq ft of the United Engineering Center site and had executed purchase contract for the remaining 3500 sq ft. On Oct. 1, 1958, title to the remaining 3500 sq ft was acquired. The site includes the entire block front on the West side of United Nations Plaza between East 47th and East 48th Streets and extends back from First Avenue for 150 ft on East 47th Street, and for 225 ft on East 48th Street.

Some 85 per cent of the land has been cleared of buildings and the site prepared for construction. Of the remaining 15 per cent of the land, only the gasoline station on the corner of United Nations Plaza and 48th Street is occupied and, under agreement, this property is to be vacated by Dec. 18, 1958.

The total cost of the land for the UEC site, including site preparation and legal expenses is computed to be $2,743,000. The cost of this land was covered by the real-estate assets of UET consisting of the market value of the present Engineering Societies Building and the accumulated Depreciation Reserve.

The New Building. The new building is estimated to cost approximately $8 million. These funds are being raised in the form of contributions from industry and individual membership of the engineering societies.

The Center will meet in full all present requirements of Founder and Associate Societies. The design provides for expansion with the continuing growth of the engineering profession and the even greater service essential for future generations. As necessary, it will incorporate every advanced feature and facility that engineering can provide.

The architects, Shreve, Lamb & Harmon Associates, are now completing preliminary drawings for the new United Engineering Center. The building is planned to be 20 stories in height in addition to penthouse and basement spaces. Gross floor area of the structure will be approximately 280,000 sq ft. Above a two-story base, the building will rise in a tower-type structure approximately 65 ft × 140 ft in plan.

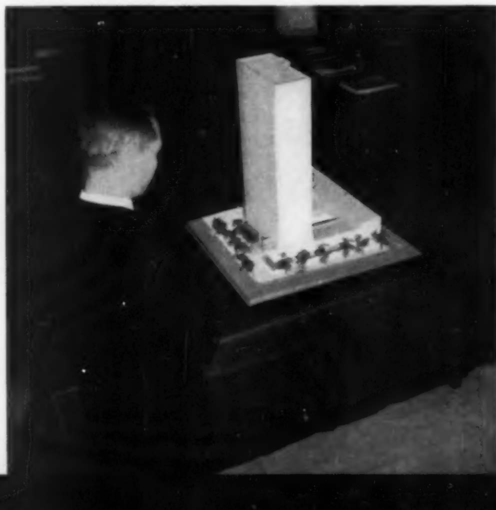
The basement, first, and second floors of the building will house the jointly used facilities of the Societies, including the cafeteria, private dining rooms, exhibit hall, large meeting room to seat 400 persons, the Engineering Library with accessory spaces, and central service offices for duplicating, shipping, and so on; all facing an attractive landscaped interior court or the street fronts.

Expansion of floor space in the future will be in a wing to be constructed to the north along 48th Street where the structural frame will be designed for additional floors.

The building will be completely air conditioned with special humidity and temperature control of the Library stack areas. Fans for office floors, air-conditioning absorption machines, and cooling tower are located in the penthouse, while fans and other equipment for the lower special rooms will be placed in the basement. Five high-speed automatic elevators are planned for the first construction stage. Structural engineers on the project are Seelye, Stevenson, Value & Knecht; mechanical engineers are Jaros, Baum & Bolles.

UEC Fund Raising. It is expected that the building will be ready for occupancy approximately Jan. 1, 1961. Completion of the new Center is dependent on raising the necessary funds from industry and society membership.

The $8 million needed to erect the new building is being raised by three fund-raising campaigns which were organized during the year: An Industry Gifts Campaign, Member Gifts Campaign, and a Greater New York Business Campaign. The Industry Gifts Campaign is to raise $5 million and the Member Gifts Campaign $3 million.



United Engineering Center model evokes a dream of the future

Industry Gifts Campaign. The Industry Campaign, under the chairmanship of Mervin J. Kelly, president of Bell Telephone Laboratories, Inc., was launched at a dinner meeting of more than 100 of America's leading industrialists at the Waldorf-Astoria Hotel on Nov. 21, 1957; the dais included the Honorable Herbert Hoover, James R. Killian, Jr., Donald A. Quarles, Ralph J. Cordiner, and Alfred P. Sloan, Jr.

Dr. Kelly keynoted the Industry Campaign "kickoff" when he said: "This new facility (the new United Engineering Center) is a must for the societies, industry, and the nation. It must be financed. The members of the societies and industry are the sources of the funds. I am confident their response will provide the amount required."

The Honorable Herbert Hoover is Honorary Chairman and Alfred P. Sloan, Jr., is Honorary Vice-Chairman of the Industry Gifts Campaign.

Organization of this Campaign has followed both regional and functional lines with significant leadership from distinguished members of the Founder Societies.

Evidence of industrial acceptance of the new Center lies in the widely diversified fields of corporate activity of subscribers to date: automotive, electrical manufacturing, oils, nonferrous metals, steels, public utilities, chemicals, and communications.

As of Oct. 17, 1958, America's leading corporations have subscribed $3,522,833 of the $5 million goal.

Member Gifts Campaign. Organization of the Member Gifts Campaign started Nov. 21, 1957 when Richard E. Dougherty, past-president of ASCE, accepted appointment as General Chairman.

The late Charles F. Kettering was Honorary Chairman and the Presidents of the five Founder Societies are Honorary Vice-Chairmen. Co-chairmen for the Member Gifts Campaign are: Enoch Needles, ASCE; J. L. Gillson, AIME; William F. Ryan, ASME; Lester Goldsmith, AIEE, and Walter Whitman and S. D. Kirkpatrick, AIChE.

Prior to Labor Day, 1958, the societies' leadership was engaged in the selection and some solicitation of advance gifts prospects and in the building of an organization for individual solicitation of their members on a national basis. The extent of this organizational effort became apparent shortly after Labor Day when there was a sharp upsurge in the number of subscriptions arriving at campaign headquarters and a consequent acceleration in total dollar attainment.

As of Oct. 17, 1958, over $740,000 had been subscribed toward the $3 million goal.

Greater New York Business Campaign. Late in 1957, a third fund raising campaign was organized when William H. Byrne, Vice-President of ASME Region II, accepted the General Chairmanship of the Greater New York Business Campaign. The Honorable Robert F. Wagner, Mayor of the City of New York, is designated as Honorary Chairman.

On May 2, 1958, the campaign had a "kickoff" luncheon at the Waldorf-Astoria which was attended by many of New York City's outstanding civic leaders.

As of Oct. 17, 1958, this campaign had secured pledges totaling $120,800.

Associate Societies in the New Engineering Center. The Board of Trustees has decided that only those organizations enjoying a 501 (*c*) (3) tax classification may occupy space in the new building. Societies other than Founder Societies occupying space in the new building shall be known as Associate Societies. Prospective Associate Societies which have expressed an interest in participating in the new United Engineering Center are: American Institute of Consulting Engineers, American Institute of Industrial Engineers, American Society of Refrigerating Engineers, American Welding Society, American Society of Heating and Air-Conditioning Engineers, and Society of Women Engineers. Several other prospective associates are, for various reasons, not yet in a position to commit themselves.

The Board of Trustees has determined that space assessment rates will be uniform for the societies' headquarters office space with no distinction between Founder and Associate Societies. In addition to Engineering Societies Library and Engineering Foundation, other joint bodies which have shown interest in being accommodated in the new Center are: Engineers' Council for Professional Development, Engineering Index, National Council of State Boards of Engineering Examiners, Welding Research Council, and Engineers Joint Council.

The responsibility for management, construction, and administration of the United Engineering Center will rest with the Board of Trustees. However, operation of the Center will be handled by a Management Committee with representation from both Founder and Associate Societies; one of the principal responsibilities of this Management Committee will be to recommend to the Board of Trustees, from time to time, proper space-assessment rates.

Similarly, it is anticipated that the Associate Societies will have a voice in the management of the Library and will share in its financial support on a uniform basis.

C. E. Davies serves as executive director of the United Engineering Center project.

Medal Boards

UET is custodian of two medal awards: the John Fritz Medal Award "for scientific or industrial achievement in any field of pure or applied science" and the Daniel Guggenheim Medal Award for "notable achievements in the advancement of aeronautics." The John Fritz Medal is administered jointly by ASCE, AIME, ASME, and AIEE, and the Daniel Guggenheim Medal is administered by ASME, SAE, and IAS.

The 1959 recipient of the John Fritz Medal is Mervin J. Kelly for his achievements in electronics, leadership of a great industrial research laboratory, and contributions to the defense of the country through science and technology.

The 1958 recipient of the Daniel Guggenheim Medal is William Littlewood, vice-president—equipment research, American Airlines, for leadership and continuous personal participation over a quarter of a century in developing the equipment and operating techniques of air transport. (Mr. Littlewood was presented with this medal at the 1958 ASME Annual Banquet.—Editor)

Finances

As of the end of the fiscal year 1957-1958, UET's Balance Sheet Assets totaled some $6.7 million, an increase of $0.9 million over the previous fiscal year.

Checking the UEC facts and figures at ASME Annual Meeting

The total real-estate assets of UET are listed as $4.4 million, and the current real-estate obligations (including UEC) total $695,246, which represents Founder Society notes, mortgages, and real-estate taxes.

Engineering Societies Library

Recognizing that the strength of our technology depends to a large extent upon the organization and availability of the world's engineering literature, the Engineering Societies Library, as the educational arm of UET, endeavors to provide engineers with a type of service unmatched elsewhere in the world. Evidence of the usefulness of the Library is demonstrated by a 19 per cent increase in use of the Library during the 1957-1958 year. Covering the various languages of the world, the Library's collection is outstanding in all fields of engineering.

The Library Board has already initiated specific planning which will permit the development of an even more useful Library in the proposed new United Engineering Center. With the expansion of facilities, the Library will be able to extend still further the quantity and the quality of its service to all engineers and to industry.

Much time and study have been given to various aspects of documentation, and especially to machine-literature searching. Interesting as the latter is, it requires much further study and development. In the meantime the Library continues to provide excellent literature searching service, continues to co-operate closely with the Engineering Index, has taken an active part in the formation of the National Federation of Science Abstracting and Indexing Services, and has affiliated with the Council on Documentation Research.

Periodicals. These are received from all parts of the world. They are important for they report new developments promptly and cover details and specific subjects not included in books.

Periodicals received	1956–1957	1957–1958
Subscription	368	360
Exchange	315	321
Gift	772	797
	1455	1478

Miscellaneous Activities. The Library Staff prepared reviews of 599 books valued at $5400. The books were received from publishers in many countries. The reviews were supplied to the editors of *Civil Engineering*, *Electrical Engineering*, "Engineering Index," *Journal of the Engineering Institute of Canada*, *Journal of Metals*, *Journal of Petroleum Technology*, Mechanical Engineering, and *Mining Engineering*, who selected and published those reviews of interest to their readers. The Library also paid $2790 for books that were not reviewed, and $5585 for periodicals.

Statistics of Library Use

	1956-1957	1957-1958
Photoprint orders	5,136	5,149
Photoprints	74,029	71,618
Microfilm	379	342
Bibliography orders	251	387
Searches and paid services	135	130
Translations	239	224
Words translated	450,574	336,751
Borrowers	1,384	1,403
Books loaned	1,799	1,855
Telephone inquiries	11,320	14,613
Written replies to inquiries	4,426	5,352
Visitors served—total	18,611	22,349
Nonvisitors served—total	23,270	27,600
	41,881	49,949

Rates on some services were increased, effective Jan. 1, 1958, as follows:

Photoprints—50 cents a print, a 5 cent increase

Translations—from German, French, Italian, and Spanish into English, $1.75 per hundred words, a 25 cent increase

Microfilm Copying—$2 for a copy of one article in one volume for each 40 pages or fraction thereof, a 50 cent increase.

Ralph H. Phelps is director of ESL. W. L. Betts and F. M. Gilbreth represent ASME on the Engineering Societies Library Board.

Engineering Foundation

The Engineering Foundation, as the research department of UET, utilizes income from its own endowment in order to stimulate basic research of broad importance to the Founder Societies.

During the past year Engineering Foundation grants of approximately $80,000 have resulted in industry support of projects totaling some $600,000.

As of this writing, the Engineering Foundation Board is carefully re-examining its policies and concepts in order to determine whether there may be other areas of endeavor in which its funds may be used more effectively.

Distribution of Foundation Grants. The distribution of Foundation grants among the Founder Societies and independently for the fiscal year ending Sept. 30, 1958, was as follows:

	Projects	*Amount*	*Per Cent*
ASCE	8	$18,000	22.5
AIME	10	30,000	37 5
ASME	8	19,000	23.8
AIEE	1	2,000	2.5
Joint	2	4,000	5.0
Independent	3	7,000	8.7
Total	32	$80,000	100.0

High Lights of the Year in Research. Progress for the fiscal year just ended, of each of the projects supported by the Foundation, is summarized in the Annual Report which is published in February and mailed to some 750 leading engineers in the United States and abroad. It seems unnecessary to give here any more than a brief outline of the year's outstanding accomplishments of a few of the more important projects.

The Council on Wave Research (EF 105) held its sixth international conference on Coastal Engineering at the University of Florida, and at Palm Beach and Miami Beach, on Dec 1–6, 1957. Fifty-four papers were presented, and the bound volume published late in August, 1958, contains 896 pages.

The volume of work being carried on by the Welding Research Council (EF 62) can be gaged with accuracy by the fact that 83 papers reporting the results of research were published during the current fiscal year. The Council now has approximately 26 projects under way, representing a research expenditure of $400,000.

The special project of the Column Research Concil (EF 84), "A Guide to Column Specifications," which is financed jointly by the Foundation and the Association of American Railroads, is virtually completed.

The Reinforced Concrete Research Council (EF 99) directed eight active research projects during the fiscal year, in addition to the special project on multiple-panel reinforced concrete floor slabs.

The Corrosion Research Council (EF 110) has been slowly but steadily increasing its support from indust:y. Its income for the fiscal year ending Sept. 30, 1958, was slightly in excess of $62,000, of which $50,000 is supporting research on the chemical reactions at metal surfaces in selected environments, and on the relation of stress to corrosion.

The research work on wood poles

(Project 109), first submitted to the Foundation in 1954 by ASTM and AIEE, has been extended to five species of poles which have been pressure treated with preservatives. This $250,000 research project at the U. S. Forest Products Laboratory will probably be finished during the coming fiscal year.

ASME representatives on the Board of the Engineering Foundation are E. L. Robinson and R. C. Allen. H. E. Martin is a Trustee representative. E. M. Barber serves as a member-at-large as well as a member of the Executive Committee. Mr. Allen also is on the Research Procedure Committee. F. T. Sisco is director of the Engineering Foundation.

Save Through Standardization, Says Hallowell at ASA 40th Annual Meeting

The American economy could save an estimated $4 billion a year through more standardization, H. Thomas Hallowell, Jr., president of the American Standards Association, stated.

Mr. Hallowell, with a keynote address on the theme, "Standardization—What's in it for me?" opened the Ninth National Conference on Standards, in New York City, November 18. The three-day conference was held November 18–20 in conjunction with the 40th Annual Meeting of ASA.

Mr. Hallowell based his estimate on a survey conducted in 1958 by ASA among more than 2000 industrial corporations.

The returns are still incomplete, he added, but a number of answers provided interesting facts and figures. For example: A manufacturer of business machines with $80,000 expenses a year for standards work saves about half a million dollars a year through standardization. Likewise a manufacturer of electronic equipment spending $24,000 a year saves $125,000. An engineering office employing 350 people saves about $25,000 a year in engineering and drafting time.

Several hundred engineers, business executives, and government officials attended the conference. Also present were 24 top-ranking foreign government purchasing officials sponsored by the International Co-operation Administration. The officials, from 14 different nations, attended as observers to study American standardization methods and conference techniques. They represented the Philippines, Ceylon, Turkey, Bolivia, Ecuador, Korea, Guatemala, Libya, Surinam, Greece, Thailand, Haiti, Honduras, and Indonesia.

Another speaker, K. B. Woods, president of the American Society for Testing Materials, predicted that the United States may eventually produce more timber than it can use. In his paper, he traced the relationship between research and standards.

"Standardization is the ultimate in the American industrial and consumer concept of development, purchasing, and use of materials," Mr. Woods said. In the 19th century, he pointed out by way of example, steel production in the United States was not standardized. When tests were made by laboratories, each company's product had to be tested separately because each product was manufactured as the individual company saw fit. Today specifications provide for standard processes of manufacture, standard chemical and physical properties, standard inspection procedures, and, above all, standard methods of testing. As a result, methods of steel testing and production have forged ahead until today the United States is the leading steel manufacturer in the world.

Topics of major importance discussed during the meeting included international standardization and standards for nuclear energy. Also, there were sessions concerned with textile standards, safety labeling for hazardous substances, and mutual benefits for producers and consumers from standards in the electronics and photographic fields.

An awards luncheon was held on Wednesday, November 19, at which time the Standards Medal was presented to W. P. Kliment, Mem. ASME, and John R. Suman received the Howard Coonley Medal for 1958, both are outstanding leaders in the field of standardization.

Principal speaker at the luncheon was the Honorable Henry Kearns, Assistant Secretary of Commerce for International Affairs who chose "Standards of Living and Standards for Trade" as his topic of discussion.

"An ever-increasing flow of trade," he said, "within our country and with the world, results in better living, greater prosperity, and higher hopes for world peace. The world flow can be increased by three steps. Removal of artificial trade barriers such as tariffs, exchange restrictions, and the like; greater effort upon the part of producers and consumers to make the world a responsive market place; and more widespread adoption of standards that provide an accurate means to measure quality, usability, description, and specifications.

"Differing standards," Mr. Kearns said, "are, in their way, as effective trade barriers as are import quotas, tariffs, currency controls, and even embargoes." All such barriers work against the free flow of trade.

American Standards Association scroll of honor presented to Henry St. Leger at ninth national Conference on Standards. *Left to right,* R. M. Gates, past-president and Hon. Mem. ASME; The Air Preheater Corporation; H. A. R. Binney, C.B., director, British Standards Institution; John R. Suman, winner of 1958 Howard Coonley Medal; Vice Admiral C. F. Hussey, Jr., USN (ret), managing director, ASA; H. T. Hallowell, Jr., ASA president; Mr. St. Leger, general secretary, ISO; The Hon. Henry Kearns, Assistant Secretary of Commerce for International Affairs; W. P. Kliment, Mem. ASME, winner of 1958 Standards Medal.

13th ARS Annual Meeting Held in New York

THE American Rocket Society, affiliate of The American Society of Mechanical Engineers, held its annual meeting Nov. 17–21, 1958, at the Statler Hilton Hotel in New York, N. Y. Top rocket and astronautical scientists and engineers from industry, the armed forces, government agencies, and educational institutions convened for a week-long conference on rockets, missiles, space vehicles, and interplanetary travel.

It was the thirteenth annual meeting for the spectacularly growing Rocket Society. Whereas their previous meetings have been held in conjunction with the ASME's Annual Meeting, sheer size now makes this impossible. This time they were on their own. Their program stated: "With sincere thanks to the ASME, and sincere regret that we could not continue our convivial relationship because of the problem of hotel space, we are off on our first solo."

Off they went, on a tremendously successful solo convention, 5000 strong (registration totaled 5430). They held 17 technical sessions in which 64 papers were presented. Their activities commanded careful attention in the nation's press. Lieut. Gen. James M. Gavin was one of their speakers.

At the same time, they held the second annual ARS Astronautical Exposition—also in the Statler—in which 56 manufacturers displayed models of space vehicles, rockets, guided missiles, and related components and equipment. Not all of the exhibits were models. (See "Briefing the Record" in this issue.)

A Year of Growth

In scarcely more than 20 years, the ARS has grown from a handful of dedicated, backyard scientists hounded from place to place (the neighbors complained), to an organization of the Nation's top scientists spearheading the most critical engineering advances of this decade. They now have 41 sections throughout the country.

The annual meeting is only one of four national meetings sponsored each year by the society. During 1958, they prepared and presented a total of 203 technical papers. There have been some 400 local meetings.

During the annual meeting, 16 special sessions dealt with nuclear rocket engines, rocket research programs, newly developed rocket propellants, space law, psychophysiological problems of man in space, space-crew qualifications, and the designing of space-sealed cabins.

Secret and confidential sessions dealt with the latest developments of ramjet fuels and ramjet electrical-propulsion systems for space travel. ("Attendance limited to the first 500 whose Clearance Forms are processed.") Secret sessions also covered the development of large solid and liquid rocket engines, and the missions that present and planned space and missile systems can accomplish.

Honors Night Dinner

At the Honors Night Dinner, held in the Statler's Grand Ballroom, George P. Sutton, Mem. ASME and outgoing president of ARS, presided. The main speaker was Lieut. Gen. James M. Gavin, USA (Ret.), now vice-president of Arthur D. Little, Inc.

The Robert H. Goddard Memorial Award went to R. B. Canright, now with the Advanced Research Projects Agency (on leave from Douglas Aircraft), for outstanding work in liquid rockets. Among many other award winners were T. W. Godwin and C. F. Lorenzo of Fenn College, Cleveland, Ohio, who won a $1000 ARS Chrysler Corporation Scholarship for their joint research in the use of fluorine in high-energy rocket engines.

F. H. Reardon, Mem. ASME, and Assistant-in-Chief, Department of Aeronautical Engineering at Princeton, received the newly established Thiokol Chemical Corporation Award for graduate students. The award was made for outstanding work with rocket-combustion instability, and for his development of a practical servo system for rocket engine control.

General Gavin told the missile industry that "the great strategic battle of the decade" will not be fought in the realm of space alone, economics alone, or technology. Speaking to an audience of more than 1000, Gavin stressed the importance of integrating military and civilian technology.

"In my opinion," he said, "the greatest incentive that can be given to our programs is a widespread awareness of the multitudinous applications of missile and space technology."

The Rocket Society's president for 1959 will be Col. John P. Stapp, Chief of Aero Medical Laboratory, Wright Air Development Center, Wright-Patterson AFB, Ohio. Col. Stapp is famous for his research in determining the pressure the human body can stand under acceleration and deceleration. The recent "manhigh" balloon flights which carried Lieut. Col. D. G. Simons to an altitude of 102,000 ft, were made under Col. Stapp's direction.

MEETINGS OF OTHER SOCIETIES

Jan. 26–27

American Society of Lubrication Engineers, first annual gear symposium, Morrison Hotel, Chicago, Ill.

Jan. 26–28

Plant Maintenance and Engineering Conference and Show, Clapp & Poliak, Inc., Public Auditorium, Cleveland, Ohio.

Jan. 26–29

American Society of Heating and Air-Conditioning Engineers, annual meeting and exposition, Bellevue-Stratford Hotel and Convention Hall, Philadelphia, Pa.

Jan. 26–29

Institute of the Aeronautical Sciences, annual meeting, Sheraton-Astor Hotel, New York, N. Y.

Jan. 28–30

Society of Plastics Engineers, Inc., annual technical conference, Hotel Commodore, New York, N. Y.

Feb. 1–6

American Institute of Electrical Engineers, annual meeting, Statler-Hilton and Sheraton-McAlpin Hotels, New York, N. Y.

Feb. 2–6

American Society for Testing Materials, Committee week, Penn-Sheraton Hotel, Pittsburgh, Pa.

Feb. 2–6

American Materials Handling Society, Hamilton Chapter, materials handling exposition, Automotive Building, Exhibition Park, Toronto, Canada.

Feb. 3–4

Instrument Society of America, national chemical and petroleum instrumentation conference, Du Pont Hotel, Wilmington, Del.

Feb. 3–5

The Society of the Plastics Industry, Inc., reinforced plastics division conference, Edgewater Beach Hotel, Chicago, Ill.

Feb. 6–7

Society for the Advancement of Management, operations research conference, Hotel New Yorker, New York, N. Y.

Feb. 13–15

National Society of Professional Engineers, spring meeting, Kellogg Center, East Lansing, Mich.

April 29–30

Institution of Electrical Engineers, convention on thermonuclear processes, London, England.

(*ASME Coming Events, see page 118*)

Notes on Society Activities and Events

E. S. NEWMAN
News Editor

THE ASME NEWS

The 1958 ASME Power Show

Equipment for Power-Plant Operation and Design, Package Boilers, Instrumentation Featured

Visitors to the twenty-third National Exposition of Power and Mechanical Engineering saw a radical nuclear fuel, portable gas turbines, and a spectacular design for disposing of waste heat in large industrial operations. Improved equipment for producing and distributing power formed the basis of the display in the New York Coliseum, December 1–5, 1958. Advances in instrumentation and integrated controls added still further means to improve the economy in manufactures of every description.

Held under the auspices of The American Society of Mechanical Engineers in conjunction with its Annual Meeting, (see pp. 74–96) the Exposition drew a registered attendance of 20,000 industrialists, scientists, engineers, and plant executives from all over the United States and Canada and some 20 foreign countries.

Atomic Power Plants. Interest in the new fuel element for atomic power plants was heightened by the introduction of a new process "coextrusion" in its manufacture. The principal component is a uranium alloy tube. This has two surfaces clad with a zirconium alloy and two integral end closures of a corrosion-resistant zirconium. Prepared sections of a similar element illustrated the dimensional uniformity and excellent bonding produced by the coextrusion technique.

Progress in atomic-power production was reflected in a number of exhibits of incidental equipment, indicating the interest of specialists in the various items entering into power plant construction.

Outstanding was a scale model of a new 100,000-kw organic moderated reactor (OMR) developed as part of the Atomic Energy Commission's program for nuclear-power development. This is based on the Commission's organic moderated reactor experiment (OMRE) which began full-power operation in February, 1958. The new plant is now being offered on the basis of fixed price and guaranteed performance.

Another exhibitor's scale model illustrated an extensive new research facility which is available for development projects of every kind. This comprehensive laboratory includes a swimming pool reactor, gamma irradiation pool, hot cells and nuclear laboratories, as well as an engineering laboratory and instrument shop.

Aviation and communications developments sparked by the military but rapidly spreading in commercial fields have led to a significant outgrowth in motor generators, phase converters, and especially in mobile sets for charging and

testing purposes. This movement was revealed in several exhibits of electrical equipment and engine-driven generators, but it reached its high point in a display of small portable gas-turbine generators.

Motor-Generator Sets. Motor-generator sets are widely used for testing purposes and for operating 400-cycle and other frequency tools. Other uses include: Fluorescent lighting, radio, radar, missiles, telemetering systems, microwave repeaters, shipboard gyrocompass, military fire control, electronic switching centers, telephone communications, nuclear reactor controls, and monitoring.

In power plants such safeguard equipment provides instrument power and chart drives, communication carrier systems, telemetering and supervisory systems, PA systems, combustion and positioning electronic controls.

Electric motor-generator sets were shown in various designs as separate equipment and also with complete controls. One-packaged unit incorporated a self-charging sealed nickel cadmium battery.

Cooling Tower. Perhaps the most radical project disclosed at the Exposition was a design for a cooling tower of reinforced concrete rising possibly as high as 350 ft into the air. Such a structure is permanent, free from motors, gears, and fans; requires no maintenance. Cooling is effected by natural draft as the hot water is percolated through an asbestos cement distributing net. Cooling towers of this description are in use in many parts of the world.

Feedwater Heater. The largest piece of equipment exhibited, and possibly the heaviest ever displayed at such an exposition was a giant feedwater heater destined for installation in a Holyoke, Mass., utility. Its weight of nearly 20 tons and length of 38 ft was of special interest because of its all-welded construction. The spherical head is formed of two formed steel hemispheres welded together and is about 3 in. thick. The tube sheets are 10 in. thick. The massive dimensions are required due to the high pressure service (2700 psi) for which it is destined. Its rate capacity is 5,000,000 gpd of water.

Package Boilers. A feature of the Exposition was the extensive display of package boilers. This included a score or more such units covering all current varieties and included sample products of one maker who produces all types, even to wood burners. One of these was the largest boiler in the show. Several makes were exhibited for the first time in a Power Show. All displayed new or improved models.

An old line maker of controlled circulation steam generators offered new 15 and 30-bhp units, oil and gas fired, with an exclusive balanced feed utilizing a liquid-level control of the feed pump.

Another fast steaming coil boiler is

The roving camera at the 1958 POWER SHOW

"ASME has 57,000 members and the benefits of membership are. . ."

Reading "Mechanical Engineering" makes one forget tired feet

"The new Foley automatic saw filer is the only machine that will handle hand, band, and all types of circular saws."

"The Automatic Switch Company will deliver these items in time to meet your deadline and. . . ."

"This is the 'Compact' made by Superior and it delivers 70 hp at 150 pounds gage pressure."

provided with an inverted burner and an external vapor drum which serves as both steam header and condensate and feedwater chamber.

Outstanding is the design of a new automatic coal-burning boiler which was developed in co-operation with the Bituminous Coal Research organization to provide maximum heating efficiency in minimum space. It combines a high efficiency water tube boiler with a unique water-cooled pulsating coal burner and is completely automatic.

Control Applications. Highlighting control applications was a receiving station which logged hourly operations of the Milliken Station of the New York State Electric & Gas Corporation near Utica, N. Y. The setup was a reproduction of the data logging system in use at that station with signals transmitted by telephone line. It was the first live demonstration of generating station performance ever exhibited.

The system is set up to monitor and log hourly 282 variables such as bearing temperatures, cooling oil and water temperatures, burner fuel pipe metal temperatures, and circulating water pump pressures. In addition to these and other items of interest to the operating department the equipment also logs and tape punches hourly 66 items, such as flows, pressures, temperatures, and powers of primary interest to the results department.

In contrast with supervisory systems are methods of automatic control of steam plant operation. One exhibitor in this field, with a line of proportional reset controllers, air and gas flow and differential pressure transmitters, remote and slave actuators, remote control stations, relays and ratio levers, is able to effect a completely automated power-plant system.

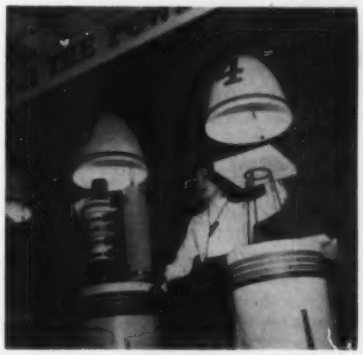
Insulation. There were several innovations in the way of insulation—for piping a calcium silicate thermobestos insulation, factory-jacketed in weather-proof aluminum, Fiberglas-reinforced resins, which offer superior resistance to most corrosive gases, fumes, and liquids, and a pipe and block insulation made of diatomaceous earth, mineral asbestos fibers and lime, which has many of the favorable characteristics of concrete, yet can be worked with ordinary tools and is light in weight.

Exhibits at the Coliseum included practically every type of equipment required in power-plant operation but also means for design, from drafting equipment to optical tooling for locating and aligning heavy equipment and even plant construction know-how, as represented by a firm of large experience in completing heavy engineering projects.

The Exposition was under the management of the International Exposition Company of New York, N. Y. E. K. Stevens, president, was manager.

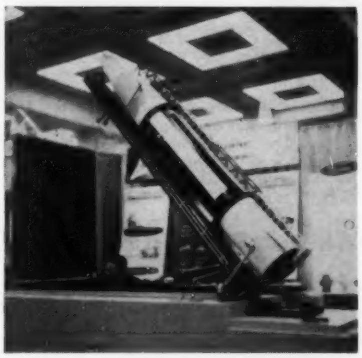
"This wire mesh, in the Yorkmesh Demister, separates liquids and vapors."

"Still another property of Fiberglas can be shown if you watch as I. . . ."



***Left,* Model of an Organic Reactor shown by Atomics International**

***Far left,* "We can just about make these three aisles before the show closes."**



Chicksan swivel joints hold the pressure as the missile swings to firing position

"I've never been this close to the top of a smoke-stack before."

1959 ASME Aviation Conference to Be Held in Los Angeles, Calif.,

THE Los Angeles Section of The American Society of Mechanical Engineers will be host to the 1959 ASME Aviation Division Conference to be held March 10 through 12 at the Statler Hilton Hotel. The theme of the symposium will deal with "The Shrinking World."

A pattern used with success to prepare the 1956 and 1958 symposiums sponsored by the ASME Aviation Division served as a guide for the Program Committee during the formulative stages of this conference. The pattern calls for sound, unclassified, technical literature which will help keep mechanical engineers informed of up-to-date advancements and to flag some problems which may be expected in the field of aviation. As the committee worked on the program content, two topics of importance to the mechanical engineer emerged.

Therefore the 75 technical papers to be presented will discuss passenger acclimation to jet transports from the engineering point of view and the operations involved with large manned-satellite systems. These two areas were made the basis of transportation on the terrestrial surface and of the earth considered as an entity in space. Both of these areas are, indeed, vital factors in the apparently shrinking size of the world in which we reside.

▶TUESDAY, MARCH 10

Jet Transports, 1—Why Noise Suppression 9:30 a.m.

Chairman: *Charley Froesch*, vice-president, engineering, Eastern Airlines

Vice-Chairman: *Matt Miller*, chief, Acoustic Section, Douglas Aircraft

Noise and Its Generation by Jets, by *Alan Powell*, UCLA

The Reaction of People to Exterior Aircraft Noise, by *L. Beranek, K. Kryter*, and *L. Miller*

A Procedure for Designing and Testing Aircraft Structure Loaded by Jet Engine Noise, by *A. Eshleman, J. Van Dyke, Jr.*, and *P. Belcher*, Douglas Aircraft

Satellite Operation, 1—Placement of Vehicles in Orbit 9:30 a.m.

Problems Associated With Assembly of a Multi-unit Satellite in Orbit, by *R. S. Wiltshire* and *W. H. Clohessy*, Martin Co.

Guidance Problems Associated With Boosting 100,000 lb Into Orbits in the 300 to 1000-Mile Range, by *R. V. Werner*, Cubic Corp.

Effects of "G" Load Limits on Problem of Establishing Large Manned Satellites in Orbit, by *R. Kaehler*, USC Kerchoff Labs.

Manned-Satellite System Design, by *W. W. Kellog*, Lockheed Aircraft

Propulsion, 1—Satellite Boosters 9:30 a.m.

Suitability of Solid and Liquid Rocket-Engine Systems for Placing Manned Satellites in Orbit, by *M. Goldsmith*, RAND Corp.

The Application of Nuclear Propulsion to Satellite Boosting, by *W. A. Moser*, Rocketdyne

Propulsion Requirements for Space-Station Erection, by *J. A. Bottorff*, Aerojet-General

On the Economy and Techniques of Large Booster Recovery, by *H. H. Koelle*, ABMA

Air-Breathing Power Plants for First-Stage Boost Vehicles, by *P. G. Kappus*, Gen. Elec. Co.

Jet Transports, 2—Design for Noise Suppression 2:30 p.m.

Chairman: *Henning von Giercke*, Wright Air Development Center

Vice-Chairman: *T. J. Schultz*

The Mechanical Engineers' Solutions for Noise Suppression, by *H. Adams*, Douglas Aircraft

Noise-Control Measures for Jet-Transport Operation, by *R. J. Koenig*, Convair

Noise Suppressors for Avon and Conway Engines, by *F. B. Greatrex*, England

Satellite Operation, 2—Maintenance and Supply of Manned Vehicles in Space 2:30 p.m.

Economic Design of Satellite-Supply Vehicles, by *Dr. Cornog*, Space Tech. Labs., Inc.

Design Requirements for In-Orbit Transfer Vehicles, by *N. Peterson*, Lockheed Aircraft

Re-Entry Problems and Design, by *J. Teaman*, Convair

Propulsion, 2—Satellite Maneuvering and Orientation 2:30 p.m.

Cesium Ion Rocket Research Studies, by *R. N. Edwards* and *G. Kuskevics*

The Role of Ion Rockets in Satellite Propulsion, by *R. H. Norris*, Gen. Elec. Co.

Low-Thrust Transfer Between Circular Orbits, by *E. Levin*, RAND Corp.

Problems Associated With the Use of Chemical Rockets for the Long-Time Control of Satellite Orbits, by *B. Augenstein*, Lockheed Aircraft Corp.

Power for Satellites, by *John Huth*, RAND Corp.

Missile and Satellite Logistics, 1—Ground Support 2:30 p.m.

Ground-Support Requirements for Boost of Satellite Into Orbit, by *J. W. Siry*, Project Vanguard, NASA

Cost Considerations in the Design of Earth-Satellite Ground Facilities, by *M. A. Margolis* and *F. S. Pardee*, RAND Corp.

▶WEDNESDAY, MARCH 11

Jet Transports, 3—Passenger Comfort 9:30 a.m.

A Quarter-Century of Transport Aircraft-Seat Design, by *S. Lippert*, Douglas Aircraft

Integration of Maximum Comfort Into the Electra Passenger Seats, by *G. E. Hanff*, Lockheed Aircraft

Passenger-Seat Comfort on the 880 Jet Transport, by *L. C. Beckett*, Convair

Pros and Cons of Forward-Reversed Seating, by *Irving Pinkle*, NASA

Boeing 707, by *P. J. Granke*, Hardmann Tool and Engineering Co.

Missile and Satellite Logistics, 2—Ground Support 9:30 a.m.

Ground-Support Equipment Trends; Surface-to-Surface Missiles, Including Manned Satellites, by *H. R. Hammond*, Food Machinery Corp.

Ground-Support Equipment Trends; Water-Based Missiles, by *W. F. Seedlock*, Lockheed Aircraft, MSD

Review of USAF Ballistic Missile Division Ground Support Program, by *A. R. Anchordoguy*, Space Technology Labs., Inc.

Airlifting Requirements for Transporting Missiles and Their Ground-Support Equipment, by *R. Flanagan*, ARDC, USAF

Satellite Operation, 3—Human Factors 9:30 a.m.

Human-Factors Design Requirements for Manned-Satellite Vehicles; A Survey of Equipment and Power Requirements, by *H. L. Wolbers*, Douglas Aircraft

Psychophysiologically Centered Space-Vehicle Design, by *A. J. Cacioppo*, Goodyear Aircraft

Environmental Control Systems for Manned-Space Vehicles, by *R. A. Nau*, Convair

Propulsion, 3—From Space Stations Onward 9:30 a.m.

Recent Developments in Ion Propulsion Systems for Space Travel, by *R. H. Boden*, Rocketdyne

Comparison of Several Propulsive Systems for Lunar and Mars Missions, by *R. S. Kraemer*, Rocketdyne

Propulsion Requirements, Simplicity, Stages, and the Like for Various Mars and Return Trajectories, by *K. Ehricke*, Convair

Power Requirements for Guidance and Communication on a Mars Mission, by *J. H. Fisher*, Electro-Optical Systems

Jet Transports, 4—Cabin Conditioning (Auspices Aircraft Air-Conditioning Forum) 2:30 p.m.

Aircraft Air-Conditioning Development Using a Thermal Mockup, by *P. F. Halfpenny* and *P. S. Starrett*, Lockheed Aircraft

Air Conditioning and Pressurization of the Convair 880 Turbojet Transport, by *R. F. North*, Convair

Liquid-Transfer Media for Airborne Thermal Systems, by *K. Tang, K. Chang*, and *J. Mason*, Airesearch

Satellite Operations, 4—Heat Transfer 2:30 p.m.

Some General Considerations of the Heating of Satellites, by *A. J. Eggers, Jr.*, Ames Research Center, NASA

Design Characteristics of Inflatable Aluminized-Plastic Earth Satellites With Respect to Ultraviolet, Visible, Infrared, and Radar Radiation, by *G. P. Wood*, Langley Research Center, NASA

Radiator Design for Space Vehicles, by *J. P. Callinan*, Loyola University; and *W. P. Berggran*, Univ. of Bridgeport

Photographic Study of Nucleate Boiling in the Absence of Gravity, by *Robert Siegel* and *C. M. Usiskin*, Lewis Research Center, NASA

Missiles and Satellite Logistics, 3—Propellants and Cryogenics 2:30 p.m.

The Large-Scale Handling of Cryogenic Fluids, by *R. B. Hinckley* and *R. E. Kendall*, Arthur D. Little, Inc.

Comparison of Handling Problems of Satellite Systems Using Cryogenic and Noncryogenic Propellants, by *D. M. Beighley*, Aerojet-General Corp.

On-Site Loading of Solid Propellants for Large Missile, Satellite Launching Units, by *W. F. Haite*, Thiokol Chemical Corp.

Problems in Handling and Transporting Nuclear Propellants, by *D. L. Hillis*, Ralph M. Parsons Co.

Propulsion, 4—Satellite Auxiliary Power 2:30 p.m.

A Comparison of the Relative Merits of Various Secondary Power Sources, by *A. P. Kelley*, Airesearch

Positive Displacement, Hot Gas Motors for Auxiliary Power, by *W. Patterson*, Vickers, Inc.

Radiation Conduction of Electric Generators, by *R. Eschborn*, Jack & Heintz, Inc.

Power Requirements and Electrical Systems for Space Vehicles, by *Ken Nelson*, Space Technology Labs., Inc.

Satellite Operations, 5—Human Factors, 2 2:30 p.m.

Submarine Simulation of Human Factors in Space Flight, by *A. E. Hickey, Jr.*, Gen. Dynamics Corp.

Performance Measures During Zero-Flight, by *E. L. Brown*, Captain, WCLDP, WADC

Artificial "G" Fields—Perception of the Vertical, by *J. T. Ray*, Lockheed Aircraft

Satellite Operations, 6—Instrumentation (Auspices Instruments and Regulators Division) 2:30 p.m.

Automation for Checkout and Monitoring in Satellite Programs, by *E. Schandl*, Missile Development, NAA

on March 10–12

Instrumentation Explorer and Results, by *H. L. Richter,* JPL
Paper title to be announced, by *E. Stuhlinger,* Redstone Arsenal, ABMA

▶THURSDAY, MARCH 12

Satellite Operations, 7—Heat Balance in Space (Auspices Heat Transfer Division) 9:30 a.m.
The Penetration of Planetary Atmospheres, by *C. Gasley, Jr.,* RAND Corp.
The Use of Lift During Re-Entry, Space Technology Laboratories, by *F. W. Hartwig,* Space Technology Labs.
Analysis of the Aerodynamic Heating for a Re-Entrant Space Vehicle, by *M. J. Brunner,* Missiles and Space Vehicles Dept., Gen. Elec. Co.
The Thermal Protection of a Re-entry Satellite, by *S. M. Scala,* Missiles and Space Vehicles Dept., Gen. Elec. Co.

Missiles and Satellite Logistics, 4—Test Facilities 9:30 a.m.
Chairman: *Dr. Lukasiewicz,* Aero, Inc.
Development of Model Telemetry and Electric Arc Gun for Use in Hypervelocity Range, by *A. J. Zassi,* Aro, Inc.
Lockheed Test Facilities in Santa Cruz Mountains, by *Mr. Hubbard,* Lockheed Aircraft
Temperature Consideration of Test for Design, by *J. B. Cladis,* Lockheed Aircraft
The Martin-Denver Rocket-Test Facilities, by *R. S. Williams,* Martin Co.
Heated-Structure Test Facilities, by *J. McGraw,* Martin Co.

Propulsion, 5—Test Facilities 9:30 a.m.
Chairman: *Dr. Goethert*
High-Altitude Test of Propulsion Systems, by *Goethert* and *Taylor,* Aro, Inc.
Operation of Ramjet Engine Ground-Test Facilities, by *S. Forsini,* Marquardt
Unique Test Facilities Requirements for Nuclear Rocket Engine Testing, by *H. T. Gittings,* LASL
Problems Associated With the Testing of Ion Thrust Chambers, by *A. T. Forrester,* Rocketdyne

Field Trips 2:30 p.m.
DC-8
Rocketdyne Field Laboratory
Jet Propulsion Laboratory

Unfired Heat-Transfer Equipment Papers Sought

The Technical Committee on Unfired Heat-Transfer Equipment has selected as subject for a session during the 1959 ASME Annual Meeting "The Air as a Cooling Medium." Those who are familiar with the subject and wish to contribute a paper to this session are requested to correspond with Mr. R. M. Armstrong, Box 566, West Chester, Pa., as soon as possible. To make preprinting possible, the papers have to be in before the end of June, 1959.

Conducted for the National Junior Committee

N. J. VIEHMANN[1]

JUNIOR FORUM

Report on National Junior Committee Meeting at 1958 Annual Meeting

By Richard S. Touma[2]

Young engineers, who often find material presented at the Annual Meeting of little interest or immediate use, would have done well to attend the session held under the auspices of the National Junior Committee on Tuesday, Dec. 2, 1958. Dynamic, spirited participation by a youthful audience followed presentation of three short but provocative papers on the theme "The Young Engineer—Which Road for His Future?" The speakers' unusually frank comments burst upon a startled but responsive audience. Exchanges of heated comments were often followed by the thunder of partisan applause. Planned deliberately to provide a friendly, informative, forum-type atmosphere, this meeting achieved its goal of informing while bringing forth a potpourri of fresh ideas.

Psychologist Looks at Engineers

Emotions were stirred by the first speaker, Harry Sherman, a consulting psychologist of New York City, with vast experience in dealing with engineers and engineering executives, who discussed "Assets and Liabilities of Engineers." Dr. Sherman examined the engineer from a psychological viewpoint and started off by investigating his (or her) mental ability or "intelligence." This he defined as "the power of independent and creative elaboration, the ability to adapt, the faculty for handling abstractions, the capacity to adjust to the environment."

Psychologists have found engineers are an intelligent group but restricted outside their particular field of specialization. Dr. Sherman reported the engineer was markedly unimaginative, using his superior mental ability in a specialized and narrow way. In addition, the engineer is concrete-minded, with a tactical rather than strategic approach, who deals in shallow surface values rather than those with depth. Engineers have been found to resent any type of ambiguity.

Engineering colleges, recognizing that engineers neglected their potentialities by channeling their mental abilities only along technical lines, have started introducing some humanities-type courses into the curriculum, Dr. Sherman observed.

Those factors within an individual which attract or repel him from various objects and activities within his environment were the next topic covered by Dr. Sherman. Engineers, he said, like technical, mechanical, mathematical, and physical science activity more than other men, while they avoid selling, advertising, publicity, routine office work, and public contact and display. Further, they do not seem to enjoy work where personal relationships are paramount and would rather deal with things than human beings. Engineers do not react strongly to peculiarities of people. It has been found engineers are avid readers, but only of technical journals in their branch of engineering and avoid high-brow or cultural magazines, in general.

In speaking of the personality traits of engineers, Dr. Sherman finds the typical engineer work-oriented, serious-minded and conscientious, and, in addition, precise, meticulous, and almost perfectionistic in his attitude to detail and accuracy. Engineers pour a greater amount of energy into their work than other people, directing it, however, to specific and attainable ends, limiting attention

[1] Product Planning Engineer, Western Electric Company, North Andover, Mass. Assoc. Mem. ASME.

[2] Project Engineer, Medical Equipment Development Laboratory, Fort Totten, Bayside, N. Y. Assoc. Mem. ASME.

to immediate matters. This often blinds him to problems of larger ramification and subtle complexity requiring a creative leap into the unknown.

Psychologists find the engineer likes to be independent, self-directing, requiring relatively little control or supervision, and actually resents close authoritative supervision. However, the engineer does maintain a positive attitude to authority and supervision.

Dr. Sherman has found the engineer to be stable emotionally but lacking skill in human relations, often trying to translate his confidence in mechanical principles and applying them to people. The engineer knows his technical job, but knows little about human principles and motivation.

The speaker concluded with this statement:

"Just one more point before closing. Frequently the engineer appears overly critical and authoritative. This stems from his enormous need to always 'be right' and his sensitivity to criticism. His self-esteem and pride hinges on his success or failure in avoiding criticism. Thus as a defense mechanism, and in order to forestall criticism from others, he sometimes goes around criticizing before others do it to him. He also fears failure. Therefore, his preference for concrete, orderly, manageable tasks, often prevents him from coming up with new creative ideas."

Adaptability

Opening his paper titled "Adaptability—Key to Survival" with a comparison of the young engineer today and a few decades ago, John de S. Coutinho, Mem. ASME, Group Leader, Analysis Group, Grumman Aircraft Engineering Company Inc., Bethpage, N. Y., immediately took a different approach. Mr. Coutinho, who is also adjunct professor, Polytechnic Institute of Brooklyn, Brooklyn, N. Y., stated that all young men leaving college start at about the same level and are then reasonably well adjusted to the everchanging world of reality. However, Mr. Coutinho thought only a few men of 45 years are equally well adjusted and, "if a young man can remain as well adjusted to reality throughout his life as he was on his day of graduation, he can't help but be a success at 45."

The speaker discussed the following six points which he considers have a bearing on a young man's eventual achievement of success.

1 Look out for yourself. You are on your own and don't expect anyone else to take care of you.

2 Know yourself. One should learn to recognize his weaknesses and strengths and see himself as others see him. Always improve your performance by being responsive to advice, criticism, and coaching.

3 Select your boss and the right advisers. Your boss is an important person having a great influence on your health, wealth, and happiness. Do not select a technical field—because they are changing and new ones are always appearing—but rather, a young man should want to work on his organization's most important technical problems.

4 Develop enthusiasm for what you are doing. Don't waste your time doing things you don't like and don't be afraid of backing out of a job which will lead to a dead end.

5 Keep up the offensive. The young man should push and continually prove to his employer he is worth a lot more than he is being paid.

6 Luck is a factor. If you keep trying, you will get your share of luck.

Mr. Coutinho's formula for success is to be the best in your age and experience group and by the time you are chronologically ready you will reach the top. The speaker said that the young engineer can improve his relative position by becoming active in ASME which he likened to a postgraduate school in the field of professional development. Here were opportunities for meeting people, making friends, selecting competent personal advisers, talking out problems, organizing meetings, presenting papers, developing latent leadership abilities, and learning the basic ethics of the engineering profession.

The afore-mentioned program requires time and energy, imagination and initiative, Mr. Coutinho pointed out, but "opportunities are unlimited for those who are willing to take advantage of them."

Specialization

Prof. Harold A. Rothbart, Associate Professor, Mechanical Engineering Department, The City College of New York, New York, N. Y., the third panelist, found some refreshingly frank and honest comments to make, often at odds with the other speakers. Professor Rothbart, who is a consultant in the field of high-speed machinery, started his paper titled, "The Tide Runs to Specialization," by discussing the various meanings of the word specialization. He emphasized his remarks by a series of personal examples and opinions gathered through years of observations and concluded that specialization may be a relatively subjective matter in the last analysis.

Initially dividing engineers into two groups, namely, the younger and because of its size the most important, and, on the other hand, the older and presently intrenched group, the speaker went on to say that this younger group because of a limitation of time, temperament, education, and experience would logically prevent specialization. The latter group because of the same factors cited would have a tendency to specialize. He noted, however, that specialization had gotten out of hand among the younger group.

Industry has in recent years invaded new and complex fields such as missiles, electronics, computers, and the like, opening up new vistas for the engineer. The speaker contrasted this picture with that of only a few years ago where the young mechanical engineer started his career as a draftsman in a few lonely fields—piping, machine design, power generation, and so on. Recently, companies by necessity have driven their engineers into groups of greater and greater specialization. Often this has had a deleterious effect upon the morale of the young engineer, Professor Rothbart conceded. He further commented that what a young man expects of industry when he leaves college is often due to overstimulation at college where a lack of reality and inability to convey the exact nature of work in the field of engineering blossoms into exaggerated dreams by the young graduate. Proper orientation at engineering school is a just and present need of education today, he concluded.

Professor Rothbart evolved the following program for the young engineer:

1 Keep going to school. Engineers should go to school at least one evening a week to keep abreast of the latest trends.

2 Look to company training programs. Close scrutiny is necessary, however, since these programs varied in their benefit to the young man.

3 Change jobs within the first few years out of school. Because the young man cannot always determine what he wants to do, what field to enter, the young graduate should experience various jobs, industries, and companies in order to determine what course to follow in the future. Stagnation often sets in after years with one firm and unless you move about you are in danger of impairing your technical knowledge and attitude and, in turn, your income. Gather all the experience possible.

4 Go to technical meetings and conferences. This will stimulate you to higher professional activity. Here is a job for both the engineer and manage-

ment. This type of activity up grades the engineer and, therefore, up grades a company's professional prestige, but the engineer must want to work to help himself, must be motivated from within.

5 Read all available literature, both technical and nontechnical to avoid personal limitations and broaden your knowledge.

6 Make as many plant trips as possible to learn and discuss your problems and ideas with experts in the field to which you aspire.

On this note Professor Rothbart concluded his discussion urging the audience to discuss further the problem of overspecialization—too soon—in a young mans' career.

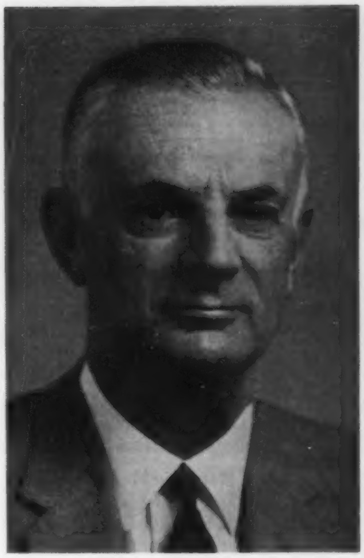
And discuss they did! Starting with a halting show of hands, discussion started with panelists describing their interpretation of success since this seemed to be the end of all the means described. Opinions varied and appeared quite subjective. Matters swung into high gear when comments were directed at the remarks of Dr. Sherman. It would be a gross understatement to say that many had been stung by these words and took serious issue with Dr. Sherman's observation.

The spotlight soon fell on the topic of engineering education and it was generally agreed that there was a need for broadening the engineers' educational requirements. However, the comment that these faults of inadequacy lay with the secondary and primary schools rather than the colleges drew a great deal of audience applause.

Another topic which drew emotional response was a discussion of the "supposed" engineering shortage by the audience and panelists. Again it could be concluded that this was a problem of lack of proper management, utilization and training, and individual recognition. And the topics ran on and on with at least 60 per cent of the large audience directly participating with the speakers until the hands of the clock forced a close to the discussion and meeting.

What would have been your comments?

W. E. Letroadec Appointed Assistant Secretary, ASME



W. E. Letroadec

Walter E. Letroadec was recently appointed to the post of Assistant Secretary of the ASME.

Mr. Letroadec has been a member of the ASME Staff since 1953. As Assistant Secretary, Personnel and Office Service, he will be in charge of the Society's Office Service, which includes staff personnel administration, purchasing, member records, shipping and supplies, and miscellaneous services. In addition, he is staff assistant to the Organization Committee and handles special assignments, such as the membership survey questionnaire, in the past, and provides staff assistance for the current ASME Member Gifts Campaign for the new United Engineering Center.

Mr. Letroadec is a graduate of Stanford University, where he received an AB degree in economics. Before joining the ASME, he was office manager of The John Breuner Company of San Francisco, Calif.; assistant to the business manager of San Francisco State College; and served as a Captain in the Army Ordnance Department, as a staff officer in the Control Division, Office Chief of Ordnance, during World War II.

ASME CODES AND STANDARDS WORKSHOP

Fluid Power Systems

By Kenneth Court, Vickers, Inc., Detroit, Mich.

The standard ASA Y32.10-1958 on Fluid Power Systems is a manual of symbols for use in graphical diagrams for fluid-power systems. Graphical symbols emphasize function and control of components and, therefore, promote better understanding of fluid-power systems.

The manual explains in detail the basic theory used to develop symbols to depict flow through all types of valves. In addition to basic symbols, complete symbols of all types of commonly used components are illustrated. Symbol rules also permit development of additional symbols for special applications.

Actual experience has proved these symbols meet circuit-diagram requirements of design, fabrication, sales, and service.

Section 11—Plastics, American Drafting Standards Manual, Y-14

By H. E. Minneman, Chairman, Subcommittee 11—Plastics ASA Sectional Committee Y-14

Section 11—Plastics of the American Drafting Standards Manual is one of the "tools" which has been developed and is currently available for use of the designers and draftsmen in the product-drafting departments of American industries and designing agencies and for engineering colleges and drafting schools which teach mechanical drafting and design.

The Section contains many recommended practices of the molding and fabricating companies which should be useful in the delineation of drawings involving components formed of plastic materials. The design and drawing hints have been supplemented with numerous illustrations. A brief description of the various forming processes and

plastic materials has been included in the section since their consideration is required in any part design.

Knurling

By A. William Meyer, Brown & Sharpe Manufacturing Company, Providence, R. I.

The recently revised standard on Knurling (ASA B5.30–1958) has been issued following a careful review of the original standard that was published in 1953.

This standard has been well received since its inception and has been a major contribution toward overcoming many of the problems formerly prevalent in knurling operations.

The standard is based on the diametral pitch system as distinguished over the former circumferential pitch system of knurling. The new system permits the economical use of blank stock of standard fractional diameters, provides better tracking, avoids to a great extent the production of broken or multilated teeth, and reduces much of the old cut-and-try methods thereby saving considerable time in setting-up operations for the job.

Since the introduction of the original standard in 1953, knurling tools have become available from several sources and the standard has come in more and more general use.

The new edition remains basically the same but revisions have been made in the text to clarify and make the standard more understandable.

ASME COMING EVENTS

February 23–26

ASME Symposium on Thermophysical Properties, Purdue University, Lafayette, Ind.

March 8–11

ASME Gas Turbine Power Conference and Exhibit, Netherlands-Hilton Hotel, Cincinnati, Ohio

March 9–12

ASME Aviation Conference, Statler-Hilton Hotel, Los Angeles, Calif.

March 12–13

ASME Textile Conference, Clemson College, Clemson, S. C.

March 16–17

ASME Lubrication Conference, The Franklin Institute, Philadelphia, Pa.

March 29–April 1

ASME Instruments and Regulators Conference, Case Institute of Technology, Cleveland, Ohio

March 31–April 2

American Power Conference, Hotel Sherman, Chicago, Ill.

April 5–10

Nuclear Congress, Cleveland Auditorium, Cleveland, Ohio

April 8–9

ASME-AIEE Railroad Conference, Sheraton Hotel, Chicago, Ill.

April 13–15

ASME Hydraulics Conference, University of Michigan, Ann Arbor, Mich.

April 19–23

ASME Oil and Gas Power Conference, Shamrock-Hilton Hotel, Houston, Texas

April 23–24

ASME Management-SAM Conference, Statler Hilton Hotel, New York, N. Y.

April 29–May 3

ASME Metals Engineering Conference, Sheraton-Ten Eyck Hotel, Albany, N. Y.

May 4–5

ASME Maintenance and Plant Engineering Conference, Edgewater Beach Hotel, Chicago, Ill.

May 12–14

ASME Production Engineering Conference, Statler-Hilton Hotel, Detroit, Mich.

May 25–28

ASME Design Engineering Conference, Convention Hall, Philadelphia, Pa.

June 14–18

ASME Semi-Annual Meeting, Chase-Park Plaza Hotel, St. Louis, Mo.

June 18–20

ASME Applied Mechanics Conference, Virginia Polytechnic Institute, Blacksburg, Va.

August 9–12

ASME-AIChE Heat-Transfer Conference, University of Connecticut, Storrs, Conn.

September 10–12

ASME Wood Industries Conference, Multnomah Hotel, Portland, Ore.

September 17–18

ASME-AIEE Engineering Management Conference, Statler-Hilton Hotel, Los Angeles, Calif.

September 20–23

ASME Petroleum Mechanical Engineering Conference, Rice Hotel, Houston, Texas

September 27–October 1

ASME-AIEE National Power Conference, Hotel Muehlebach, Kansas City, Mo.

October 20–22

ASME-ASLE Lubrication Conference, Hotel Sheraton-McAlpin, New York, N. Y.

November 29-December 4

ASME Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

(*For Meetings of Other Societies, see page 110*)

Note: Members wishing to prepare a paper for presentation at ASME national meetings or divisional conferences should secure a copy of Manual MS-4, "An ASME Paper," by writing to the ASME Order Department, 29 West 39th Street, New York 18, N. Y., for which there is no charge providing you state that you are a member of ASME.

How Well Do You Know Your Society?

So that the members of ASME may know their Society, attention is called to the list of Manuals and Annuals available upon request from the ASME Order Department, 29 West 39th Street, New York 18, N. Y. Unless otherwise noted, all the items in the list will be sent without charge, one copy of each per member.

AC 2 Annual Report of ASME Research

AC 10 Personnel of Council, Boards, and Committees

AM 1 Membership List—Alphabetical and Geographical (Biennial—odd-numbered years)

AM 3 Catalog of Publications (also included in "Mechanical Catalog")

AM 4 Members List—Listed by Companies (Biennial—even-numbered years, $2 each)

AM 5 Indexes to ASME Papers and Publications (Published annually in January issue of *Transactions of ASME*)

MS 4 An ASME Paper (50 cents to nonmembers)

MS 61 Citizenship and Participation in Public Affairs

35 Years Young . . . Woman's Auxiliary to the ASME celebrates its 35th birthday at a luncheon held at Delmonico's Penthouse Restaurant. Mrs. E. Oberg, *right*, and Mrs. R. W. Worley, National President, admire birthday cake.

The 35th Anniversary of the Auxiliary

1958 Annual Meeting of the Woman's Auxiliary to the ASME

THE Woman's Auxiliary to The American Society of Mechanical Engineers celebrated its Thirty-Fifth Anniversary at its Annual Meeting in New York, N. Y., November 30 through December 5, 1958. Honorary Chairman of the meeting was Mrs. Robert W. Worley of Philadelphia, Pa., who was re-elected National President of the Auxiliary. Three hundred and sixty-six women from all over the country registered at Headquarters where they were warmly greeted by Sunshine Committee members serving under Mrs. Christian Bertelsen, chairman, and Mrs. Marie E. Michal, Mrs. C. R. Mockridge, vice-chairmen.

Metropolitan Section, Hostess. The Metropolitan Section was hostess to the visitors. Officers of the Annual Meeting Program were: Mrs. Erik Oberg, general chairman; Mrs. John C. Gibb, vice-chairman, Mrs. William H. Bryne, vice-chairman, Mrs. William Hausmann, vice-chairman; and Mrs. Gordon Hahn, chairman of The Metropolitan Section.

Registration. Registration was held on Sunday, November 30 from 2:00 to 5:00 p.m. in the Pennsylvania Room of The Statler Hilton and daily thereafter from 8:00 a.m. to 6:00 p.m. Mrs. Raymond W. Oakley was chairman of registrars. Mrs. C. H. Kent, Mrs. F. H. Linley, Jr., Mrs. Eugene H. MacNiece, assisted her.

Early Bird Party. The Sunday get-together from 4:00 to 7:00 p.m. at the National Arts Club attracted a capacity crowd of 400 ASME men and women. Mrs. William Hausmann, chairman of this event, had Mrs. Rudolph F. Gagg and Mrs. J. W. Wilkenfeldt assisting her as vice-chairman. The committee working with the chairman achieved a beautiful decor with the lavish use of evergreens and gold-tinted cones. An attractive hors-d'oeuvres table was frequented and appreciated. While old acquaintances were renewed and new ones begun, Gustav C. Spahr of Philadelphia, Dr. A. H. Moody, and Miss Arden Anderson of New York provided, in turn, background music on the piano.

Changes in Program. The 1958 program of events for the ladies had been carefully worked out in accordance with the wishes of the Annual Meeting Policy-Making Committee of which Arthur Perrin was chairman for the men, and Mrs. Erik Oberg was chairman for the women. This committee eliminated conflicts in programs arranged by the Metropolitan Section, Host Section of the ASME, and the Metropolitan Hostess Section, thus insuring maximum attendance at all events. The Annual Banquet, Reception, and Dance scheduled for Thursday night instead of Wednesday was the biggest single change in programming. The Tea Dance, customarily on Monday was held instead on Tuesday. Other events were planned around these two major changes.

The Coffee Hours. Every day of the week from 8:30 to 9:30 a.m. coffee was served in the Cornell Room much to the pleasure of the ladies who had come to the adjoining Pennsylvania Room to register for the many events. Chairmen of these successful coffee hours were Mesdames Wockenfuss, Pool, Cooper, and Salma; vice-chairmen were Mesdames Grabowski, SarVant, Staller, Wallace, Jr., Winter, Brown, Felbeck, Huey, and Markert.

The President's Luncheon. The President's Luncheon held in the Grand Ballroom at 12 noon was well attended by the ladies who had been invited to join the men at this impressive affair. Our National President, Mrs. Robert W. Worley, who had been invited to speak, brought out that the goal of the Auxiliary, with 27 sections and a membership close to two thousand, is a section for every Section of ASME. Mrs. Worley reported on The Educational Funds and the importance of the ASME to the Auxiliary—the latter being "not good if detached."

Auxiliary Workshop. Continuing a custom established at the 1957 Annual Meeting a workshop was scheduled for all members to discuss with National officers and chairmen, problems pertaining to the Auxiliary. Under the chairmanship of Mrs. Walter F. Friend, it was held in the Cornell Room from 2:00 to 3:00 p.m. Dr. Lillian Gilbreth, Hon. Mem. of the Auxiliary, addressed the Workshop audience which included chairmen of distant sections. Emphasis was placed on educating members to read MECHANICAL ENGINEERING and so become better acquainted with ASME.

Student Aid Room. An innovation this year was the Student Aid Room where coffee and cake were served to the Student Aids who assisted at the sessions. U. A. Rothermel, general chairman of the Student Aid program, had appointed a chairman for each day. These chairmen were assisted by a Hostess Committee including Mrs. W. Hausmann, general chairman, and Mesdames Burdick, Cockrell, Gagg, Grabowski, Harman, Moro-Lin, Whitacre, and Willen.

The Social Hour. An informal complimentary get-together for all members of the ASME and the Auxiliary was held Monday evening in the Georgian Room

at 8:00 p.m. An unusual program provided by Scandinavian Airways System presented ten International Dancers in colorful costumes, a singer, and commentator. Their theme was "Around the World with S.A.S. by Air." As the imaginary plane landed in various countries the outstanding dance of each country was demonstrated. About 9:00 p.m. for variety, the guests were taken to many countries via a brilliantly executed movie. After refreshments of punch, coffee, and cookies, there were competitive games which caused a great deal of hilarity and much vying for the prizes. Guests were invited to take part in the dancing lessons, then more Old World dances followed. Mrs. F. Vermilya was chairman of this well-attended event, assisted by Mrs. S. H. Anderson and Mrs. S. Reid, vice-chairmen, who, with their committee, wore delightful costumes of various countries.

Annual Business Meeting. The Annual Business Meeting held Tuesday at 10:00 a.m. in the Dallas Room, with Mrs. Worley presiding, opened with a moment of silent prayer. The 75 members attending had the pleasure of meeting outgoing ASME President J. N. Landis and Mrs. Landis; incoming ASME President Glenn B. Warren and Mrs. Warren; O. B. Schier, II, Secretary of ASME; and William F. Ryan, Council Representative for the Auxiliary.

Mr. Warren in his talk praised engineers for their contribution to the present high standard of private living but pointed out the great need for their aid in raising the public standard of living by the development and use of new and effective tools for teaching, public service, hospitals, and roads.

Section Certificates of Organization signed by the President and the Council Representative in office at the time the Section was organized were presented. Annual reports from all Sections were read.

Celebrating the Thirty-Fifth Anniversary, a history of the Auxiliary had been prepared under the chairmanship of Mrs. R. W. Oakley. The history which also includes a description of the four Educational Funds, was presented, one to a Section. These Thirty-Fifth Anniversary histories are expected to be made available to members wishing to purchase them.

Mrs. C. C. Franck, chairman of the Tellers Committee which included Mrs. R. E. Frank and Mrs. W. Pugh reported on the elections. The new officers include: Mrs. R. W. Worley, Philadelphia, re-elected President; Mrs. T. N. Graser, Boston, First Vice-President; Mrs. Erik Oberg, Metropolitan, Second Vice-President; Mrs. W. G. Waltermire, Cleveland, Third Vice-President; Mrs. A. Chapman, Detroit, Fourth Vice-President; Mrs. W. J. Greenwald, Minnesota, Fifth Vice-President; Mrs. C. H. Kent, Metropolitan, Recording Secretary; Mrs. A. Kisner, Philadelphia, Corresponding Secretary; Mrs. G. Hahn, Metropolitan, Treasurer; and Mrs. J. W. Wilkenfeldt, Metropolitan, Assistant-Treasurer.

The following were appointed to the Nominating Committee for next year: Mrs. W. H. Larkin, Metropolitan, chairman; Mrs. G. E. Crofoot, Philadelphia, Mrs. J. N. Landis, San Francisco, Mrs. E. W. Allardt, CAM; and Mrs. R. Goetzenberger, Washington.

Specialists in management. Shown *left to right* are: Mrs. E. Oberg, General Chairman of the 35th Annual Meeting of Woman's Auxiliary to the ASME; Mrs. R. W. Worley, National Chairman of the Auxiliary; Mrs. A. M. Perrin, Chairman, Annual Luncheon and Fashion Show held at the Waldorf-Astoria Hotel; Mrs. G. B. Hahn, Metropolitan (Hostess) Section Chairman; and Mrs. W. H. Byrne, Mrs. J. C. Gibb, Mrs. William Hausmann, Vice-Chairmen of the meeting.

At the close of the Annual Business Meeting, members went to the adjoining Buffalo Room where a sandwich, coffee, and pastry luncheon was ready and waiting.

Annual Tea Dance. The Tea Dance for all men and women attending the Annual Meeting was held in the Georgian Room on Tuesday from 4:00 to 7:00 p.m. In charge were Mrs. H. R. Kessler, chairman; Mrs. R. B. Purdy, vice-chairman in charge of decorations; and Mrs. W. H. Byrne. The impressive tea table was adorned with a centerpiece of carnations ranging in color from pale pink into deep red, placed on ferns, and flanked by pink candles. A pink skirt draped around the table enhanced the pretty pink mood. Pouring for the occasion were Mesdames Bailey, Byrne, Friend, Goetzenberger, Hahn, Karg, Kent, Landis, Miller, Pilcher, Warren, Worley, and Wilkenfeldt. Jim Harkin's orchestra provided the music for this popular event, which, as usual, attracted a large attendance.

Night Club Tour. Under the expert guidance of Glass Dome Tours, immediately following the Tea Dance, a group left the Statler Hilton Hotel for the popular Latin Quarter. Here dinner was served followed by a spectacular floor show. According to some of the guests the show equaled that of the famous Lido in Paris. At the completion of the show the party moved on to the Cafe Wienecke in Yorkville, an attractive night club in the German tradition, for another show with outstanding singers and dancing. Chairman of this tour was Mrs. J. L. Mazaika, assisted by Mrs. R. G. Hess, and Mrs. J. T. Vollbrecht, vice-chairmen.

National Board Breakfast and Meeting. Wednesday morning at 8:00 a.m., about 50 Board Members and delegates gathered in the Terrace Lounge for breakfast. At the meeting which followed, with Mrs. Worley presiding, it was voted to give $1000 over a three-year period to the new United Engineering Center.

Glass-Blowing Program. More than 50 women attended the glass-blowing program at 9:30 a.m. in the Gold Ballroom Foyer and found it interesting and educational. Miss Grace Howell, noted lecturer and demonstrator, had brought in her elaborate equipment to produce handblown glass in colorful variety as she talked. The pieces she produced went to the lucky winners of the door prizes. After the demonstration the ladies purchased Christmas presents from a sparkling collection of Miss Howell's blown glass. Miss Howell gave 20 per cent of receipts to the Auxiliary's Educational Funds. Chairman of this

event was Mrs. J. C. Gibb, assisted by Mrs. J. J. Moro-Lin and Mrs. J. E. Stevens, vice-chairmen.

Annual Luncheon—Wednesday. The Annual Luncheon which was held in the Sert Room of the Waldorf-Astoria drew a large audience. The room was festive with gold-colored linen and green ferns on the tables. The head table was decorated with mums of all sizes, in shades of rust and gold, with magnolia leaves hanging below, and white candles. Mrs. A. Perrin, Second Vice-Chairman of Metropolitan Section, was chairman of the luncheon. Mrs. T. H. Wheelock decorated the head table. Mrs. R. Gagg, decoration chairman for the entire Annual Meeting was in charge of table decorations. Vice-chairmen of the day were Mrs. W. H. Byrne and Mrs. G. Harman. The meeting was opened when the head-table guests came in; The Lord's Prayer by A. H. Malotti was sung by one of the Metropolitan Members, Miss Arden Anderson, accompanied at the piano by Mrs. L. Novotny. After the luncheon, Mrs. Erik Oberg welcomed all the guests and introduced the head table. Honor guests on the dais were: Mrs. Landis and Mrs. Warren. Others on the dais were Mesdames Bristol, Byrne, Friend, Hausmann, Kent, Pilcher, Wheelock, Wilkenfeldt, and Mrs. Hahn who extended greetings on behalf of the Hostess Section. Mrs. Oberg introduced Mrs. Worley, National President of the Auxiliary, who spoke briefly. Her theme was, "It is not history that makes a strong Auxiliary but a strong Auxiliary that makes history." The General Chairman then introduced Mrs. Perrin, who introduced Mrs. Gibb. Mrs. Gibb then presented the speaker, Mrs. Edward R. Murrow, wife of the famous television and radio commentator. Mrs. Murrow gave an informal and interesting address. The topic "Scenes from the Sidelines," including a résumé of life during war time in England, when she was broadcasting a series of programs on American History over B.B.C.

A fashion show followed with costumes from sportswear to full evening gowns and furs; the theme: "Flaming Youth to Magnetic Maturity." The majority of the models were members of the Metropolitan Section. Gracious and charming models they were. Chairman of the models: Mrs. J. W. Wilkenfeldt. Following the drawing for the door prizes, Mrs. Oberg, introduced the soloist, Miss Anderson, who closed the gay affair by singing "Wunderbar."

The Cocktail Hour. Following a bus tour of the site for the new Engineering Building at 47th Street and United Nations Plaza, a tour of the present Engineering Societies Building at 39th Street was arranged under the direction of Ernest Hartford. The ladies were invited to join their husbands for a cocktail hour at 5:00 p.m. in the Main Lobby. This affair was capably handled by Mrs. A. Peeler, chairman, Mrs. R. W. Cockrell and Mrs. J. Teufel, vice-chairmen.

The Theatre Party. Wednesday evening was reserved for a theatre party. The Hostess Section arranged for theatre tickets to be purchased in advance from the Theatre Party chairman, Mrs. C. Dunham. All available tickets for "My Fair Lady," "The Music Man," and "Two for the Seesaw" were sell-outs. This new addition to the Annual Meeting program met with much approval.

The Revlon Program. The Revlon program, a complimentary program held at 9:30 a.m. in the Gold Ballroom Foyer, was given by Miss Noel Gordon, School Supervisor for Revlon. It also played to a full house. One of the Metropolitan Section members acted as model for the make-up part of the program. The demonstration was followed by a lively, interesting "question" and discussion period. The chairman was Mrs. R. W. Cockerell. Vice-chairmen were: Mrs. M. S. Block and Mrs. C. Reynell.

Tour of the S. S. Independence and the Thirty-Fifth Anniversary Luncheon. At 9:30 a.m. chartered buses left the Statler Hilton for the American Export Lines' beautiful passenger liner, the *SS Independence*. Following this enjoyable tour, guests boarded the bus for the 146-year old Delmonico's restaurant in the heart of the financial district. Here, in the Penthouse, the Auxiliary celebrated its birthday party with 100 guests participating. Mrs. R. S. Cooper, chairman of decorations, had effectively carried out the blue and gold color scheme with the use of gold and blue balloons, blue candles and gilded magnolia leaves. Head-table guests took their seats to the strains of the Anniversary Waltz. Mrs. Oberg announced a solo to be sung by Miss Dawn Madigan, accompanied by Mrs. Novotny; and introduced the composer, Mrs. J. J. McCarthy, of Philadelphia.

After the guests had served themselves at the buffet table, the Birthday Cake, a handsome gold and blue decorated confection, was brought to the table. Mrs. Worley cut the first piece to the tune of "Happy Birthday" sung by all. The cake was passed to all tables. Following luncheon, Mrs. Oberg introduced the guests at the head table. They included: Mrs. R. W. Oakley and Mrs. A. Peeler, vice-chairmen of the Luncheon; Mrs. R. S. Cooper, decorations chairman; Mrs. J. J. McCarthy; Mrs. Hahn, chairman of Metropolitan Section; Prof. George B. Thom, chairman of the ASME Metropolitan Section; Mrs. R. W. Worley, National President; Mrs. J. C. Gibb, chairman of the Luncheon, and Miss Raymonde I. Paul, guest speaker.

Prof. Thom, representing The Host Section, expressed his pleasure at being present. Mrs. Worley gave the "Salute to The Anniversary" with best wishes for many happy returns of the day.

Mrs. Gibb asked her Luncheon Committee to stand to receive the credit due for all the fine assistance they had proffered. She then introduced the guest speaker, Miss Raymonde I. Paul, who spoke briefly and brilliantly on "International Law and You," receiving applause that amounted to an ovation.

Mrs. Oberg asked all Metropolitan Section Board Members to stand and receive honorable mention for their steadfast support through the year of all Annual Meeting plans and preparations.

Miss Madigan then sang the Auxiliary song, composed by Mrs. McCarthy, "The Spirit of ASME," with all joining on the second chorus.

With Professor Thom drawing the first door-prize number and Mrs. W. H. Byrne the others, and Mrs. A. Perrin giving out the prizes, this festive and happy party came to a close.

Tour, Luncheon, and Talk at United Nations. By popular request the UN program was repeated again this year. This time the Hostess Section made it a joint affair—attended by a large party of men and women. The tour of the buildings began at 10:30 a.m. and was followed by luncheon in the Delegates' dining room. Arrangements had been made for one of the outstanding speakers of the UN, Mrs. S. Standen, to address the group in one of the private meeting rooms after luncheon. She spoke on the World Health Program in which 88 nations participate, 81 of whom are members of the UN. Interest in her talk ran high and Mrs. Standen was delighted with the number of questions asked. Since, fortunately, there was a General Session in progress, it provided the group with an exciting climax to their UN visit. Mrs. W. Friend, chairman; Mrs. W. Becker and Mrs. C. R. Mockridge, vice-chairmen, were assisted by an able committee.

The Hostess Section, mindful of the wonderful spirit shown by those preparing for the Annual Meeting, hopes the contagion of it will have sufficiently touched all attending that they take home a new affection and renewed enthusiasm for their esteemed Auxiliary.

Apply for Freeman Fellowship for Study or Research in Hydraulics

ASME and ASCE Members Eligible

Qualified members of the American Society of Civil Engineers or The American Society of Mechanical Engineers, who have a worthy research program in hydraulics or related fields, may apply for Fellowship support to the Freeman Award Committee of ASCE in an amount not exceeding $3000, depending on the need claimed in the application.

ASCE and ASME are each administrators of a Freeman Fund. The Freeman Award Committees make awards through these Societies in alternate years (through the ASCE Committee in 1959). The conditions under which Fellowship applications will be studied are the following:

1 Each applicant must submit a detailed study or a research program covering a period of at least nine months starting in 1959. Each shall include a statement of the funds needed from the Fellowship.

2 Each applicant shall furnish evidence of his qualifications to carry out the proposed program.

3 Applicants must be citizens of the United States and members in some grade of either of the two co-operating Societies.

4 Applications must be submitted to the Freeman Award Committee, c/o Secretary, the American Society of Civil Engineers, 33 West 39th Street, New York 18, N. Y., by March 1, 1959.

5 A report in English must be made by the awardee within 60 days after completion of his project.

6 The income from the Fund is to be used in the aid and encouragement of young engineers, especially in research work for:

(*a*) Grants toward expenses for experiments, observations, and compilations to discover new and accurate data that will be useful in engineering.

(*b*) Underwriting fully or in part some of the loss that may be sustained in the publication of meritorious books, papers, or translations pertaining to hydraulic science and art which might, except for some such assistance, remain mostly inaccessible.

(*c*) A prize for the most useful paper relating to the science or art of hydraulic construction.

(*d*) A traveling scholarship, open to members younger than 45 years, in any grade of membership, in recognition of achievement or promise; and for the purpose of aiding the candidate to visit engineering works in the United States, or any other part of the world, where there is good prospect of obtaining information useful to hydraulics engineers.

(*e*) Assisting in the translation or publication, in English, of papers or books in foreign languages pertaining to hydraulics.

CANDIDATES FOR MEMBERSHIP AND TRANSFER IN ASME

The application of each of the candidates listed below is to be voted on after Jan. 23, 1959, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

New Applications and •Transfers

Alabama

Brown, Clyde H., Jr., Fairfield
Christiansen, Gordon E., Decatur
Davis, Walter H., Jr., Decatur
Hodgson, Voigt R., Huntsville

California

Bjorklund, Glenn J., Torrance
Coale, Charles W., Portola Valley
Crull, Marvin L., Lakewood
Garret, Andre, Oakland
Johrde, Raymond A., San Francisco
Landler, George, Canoga Park
Lauener, William F., Riverside
Mann, Melvin S., Burbank
Scott-Brown, Peter, Manhattan Beach
Stillman, Paul E., Los Angeles
Travaglio, Dalny, Palo Alto
Vanderwier, John G., Campbell

Connecticut

Berman, Robert, New London
•Clark, Joseph H., Jr., Trumbull
•Gill, John J., South Norwalk
Greten, Warren A., Hartford

Delaware

Menzin, Marvin, Wilmington
Polak, Willem, Wilmington
Roy, Leopold R., Newark

District of Columbia

Misch, Franz H., Washington

Florida

Grimm, Dale R., Miami
Taylor, Francis W., Pensacola

Georgia

Griffin, Marion L., Atlanta

Idaho

Schweiger, Lewis J., Idaho Falls

Illinois

Brink, George F., Northlake
•Brousek, James C., Broadview
Johnson, Kenneth G., Aurora
Jones, Marion, Metropolis
MacDonald, Alister, Chicago
Mawdsley, Irvin H., Coal Valley
•Miller, Robert F., Chicago
•Novak, Leo L., Park Forest
Peterson, Bertil E., Chicago
Roush, Muriel F., Chicago
•Stith, Jesse H., Freeport
Wheelock, Ned B., Joppa

Indiana

Nelson, William F., Plainfield

Iowa

•Hudson, Wellborn R., Jr., Iowa City
•Wallace, James A., Cedar Rapids

Kentucky

Pigott, Joe C., Paducah

Louisiana

LeBlanc, Randolph A., Sr., Franklin

Maryland

Hunt, George E., Jr., Baltimore
Jones, Hugh M., Pasadena
Libb, Howard Z., Baltimore
Read, Kenneth F., Annapolis
Staup, Clyde G., Linthicum Heights

Massachusetts

•Bakerjian, Benjamin H., Needham Heights
•Blanchard, Ralph S., Jr., Cochituate
Driscoll, John R., Hopedale
•Feener, Donald H., Norwood
Gaulin, J. P. Roger, Millbury
Gordon, Morris J., Brookline
Medoff, Louis S., Cambridge
•Potocki, Edward F., Springfield
Renaud, Francis L., Bedford
Schuetzenduebel, Wolfram G., Worcester
Wright, Robert L., Jr., Boston

Michigan

Beyer, Frank R., Dearborn
Madsen, John R., Detroit
Spinner, David, Oak Park
Tewary, C. B., East Lansing

Minnesota

Dmowski, George L., Sr., Minneapolis

•Transfer to Member or Affiliate.

Missouri

●DICKERHOFF, DONALD C., St. Louis
FARNSWORTH, DENNIS G., St. Louis
REULAND, WILLIAM B., Kansas City
WOOD, ROBERT G., Kansas City

New Jersey

BLUM, EDWARD J., Rutherford
FOTI, ANTHONY J., Newark
HAYS, DONALD C., Red Bank
LEHMANN, HAROLD C., New Providence
MUJICA, JULES A., Fords
NELKEN, HARVEY H., Riveredge
●OLSEN, WILLIAM W., Haddonfield
SIDDLE, KENNETH R., Waldwick
UDERITZ, RICHARD A., Elizabeth
WILLIAMS, KENNETH R., Saddle River

New York

●AUERBACH, PHILIP B., New Hyde Park
BAILEY, RODERICK F., Elmira
FOREMAN, EDGAR S., JR., Staten Island
FRIEDLANDER, MICHEL O., Bethpage, L. I.
GILMOUR, WILLIAM K., Great Neck
GOMEZ, LLOYD E., Schenectady
GOODRIDGE, PAUL F., Wellsville
KAPLAN, DAVID, Mount Vernon
KITTELBERGER, KARL H., Rochester
MORELLI, OMAR J., Kew Gardens, L. I.
●MORGENSTERN, MAX A., Bronxville
PARSONS, LESTER J., Queens Village
●ROSS, BERTRAM, Schenectady
SARMENTO, ROBERTO M., New York
SCHLOEMER, HOWARD H., New York
SHOPMYER, WILLIAM F., Poughkeepsie
SIMPKINS, ANDREW G., Niagara Falls
SWENSON, CARL A., New York
TATARSKY, GEORGE E., Yonkers
WUNDT, BORIS M., Schenectady

Ohio

ALBRECHT, PAUL, Cincinnati
CASSELL, HOWARD A., Cuyahoga Falls
●COLEBROOK, JAMES M., Cincinnati
●CORNISH, ROBERT F., Canton
ERWIN, JOHN R., Cincinnati
GREGG, JOHN L., Elyria
HEADY, PEARL T., North Bend
HESS, RAYMOND E., Columbus
HUEBLER, JACK, Sylvania
MISIAK, GREGORY, Columbus
SALMEN, WALTER J., Alliance
●STEWART, JACK M., Cleveland
WEISEL, WILLIAM E., Cincinnati
●WISE, HERBERT A., JR., Springfield
WOLFE, JOHN R., Massillon

Oklahoma

●ECHOLS, E. J., Tulsa
SMITH, ALVA C., Tulsa
WALTS, MELVIN C., Tulsa

Oregon

●TALBOTT, JOHN A., Portland

Pennsylvania

BEER, FERDINAND P., Bethlehem
BITTERLICH, GORDON M., Wayne
COX, CHARLES R., Pittsburgh
CREATI, ANTHONY J., Philadelphia
FLETCHER, ROBERT J., Philadelphia
FLYNN, WILLIAM J., Philadelphia
●GOLDENBERG, DAVID, Johnstown
HAM, INYONG, University Park
HEGER, JAMES J., Pittsburgh
HOWARD, GEORGE S., Swarthmore
KALETKA, ALBERT C., Farrell
LINDAUER, GEORGE C., Pittsburgh
MILLER, ROY N., Newton Square
●PIER, JEROME R., Wilmerding
TODD, WILLIAM T., II, Pittsburgh
●WADDLE, PAUL H., JR., Johnstown
WANDRISCO, JOSEPH M., Monroeville

South Carolina

●NEMETH, STEPHEN R., Aiken

Tennessee

TURNER, ERRETT E., JR., Maryville

Texas

CLINE, HOWARD L., Houston
GREEN, JOHN E., Houston
REESBY, CARL E., Houston
STILLEY, WILL'R., Corpus Christi
VAN SICKLE, DONALD R., Houston

Virginia

WEINBERG, LAWRENCE, Alexandria

West Virginia

DALIN, ROBERT W., Ravenswood

Keep Your ASME Records Up to Date

The ASME Secretary's Office depends on a master membership file to maintain contact with individual members. This file is referred to countless times every day as a source of information important to the Society and to the members involved. All other Society records are kept up to date by incorporating in them changes made in the master file.

The master file also indicates the Professional Divisions in which members have expressed an interest. Many Divisions issue newsletters, notices of conferences or meetings, and other material. You may express an interest in the Divisions (no more than three) from which you wish to receive any such information which might be published.

Your membership card includes key letters, below the designation of your grade of membership and year of election, which indicate the Divisions in which you have expressed an interest. Consult the form on this page for the Divisions to which these letters pertain. If you should wish to change the Divisions you have previously indicated, please so notify the Secretary.

It is highly important to you and to the Society to be certain that our master file indicates your current mailing address, business or professional-affiliation address, and interests in up to three Professional Divisions.

Please complete the form, being sure to check whether you wish mail sent to your residence or office address, and mail it to ASME, 29 West 39th Street, New York 18, New York.

Please Print **ASME Master-File Information** Date

LAST NAME FIRST NAME MIDDLE NAME

POSITION TITLE NATURE OF WORK DONE
e.g., Design Engineer, Supt. of Construction, Manager in Charge of Sales, etc.

NAME OF EMPLOYER (Give name in full) Division, if any

*☐
EMPLOYER'S ADDRESS City Zone State

ACTIVITY, PRODUCT, or SERVICE OF EMPLOYER; e.g. Turbine Mfrs., Management Consultants, Oil Refinery Contractors, Mfr's. Representative, etc.

*☐
HOME ADDRESS City Zone State

☐
PRIOR HOME ADDRESS City Zone State

* CHECK "FOR MAIL" ADDRESS

I subscribe to *Address changes effective when received prior to:*

☐ MECHANICAL ENGINEERING — 10th of preceding month
☐ Transactions of the ASME — 20th of preceding month
☐ *Journal of Applied Mechanics* — 20th of preceding month
☐ *Applied Mechanics Reviews* — 1st of preceding month

Professional Divisions in which I am interested (no more than *three*) are marked X.

☐ A—Aviation
☐ B—Applied Mechanics
☐ C—Management
☐ D—Materials Handling
☐ E—Oil and Gas Power
☐ F—Fuels
☐ G—Safety
☐ H—Hydraulics
☐ J—Metals Engineering
☐ K—Heat Transfer
☐ L—Process Industries
☐ M—Production Engineering
☐ N—Machine Design
☐ O—Lubrication
☐ P—Petroleum
☐ Q—Nuclear Engineering
☐ R—Railroad
☐ S—Power
☐ T—Textile
☐ U—Maintenance and Plant Engineering
☐ V—Gas Turbine Power
☐ W—Wood Industries
☐ Y—Rubber and Plastics
☐ Z—Instruments and Regulators

GUY, NORMAN D., St. Albans
LOUDIN, LOY L., Parkersburg
NEGLEY, CHARLES F., Charleston
VANDERWILT, CORNELIUS J., Charleston
YOUNG, PETER A., JR., Ravenswood

Wisconsin

HEMPHILL, JAMES E., W. Allis
PERRAULT, DUANE P., Rhinelander

Foreign

•ACKLAND, JOHN M., London, England
AGRAWAL, LALJI P., Jabalpur, India
ASHCROFT, SAMUEL R., Montreal, P. Q., Canada
BEDI, MOHINDER S., Jai Pur, India
LAURIE, ERNEST S., Montreal, P. Q., Canada
NOTLEY, WILLIAM J., Toronto, Ont., Canada
PETERSEN, KNUD V., Brazil, S. A.
PURI, GOPI N., New Delhi, India
RAMADAN, NABIH A., Damascus, Syria, UAR

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC (Agency)

THESE items are listings of the Engineering Societies Personnel Service, Inc. This Service, which co-operates with the national societies of Civil, Electrical, Mechanical, and Mining, Metallurgical, and Petroleum Engineers, is available to all engineers, members or nonmembers, and is operated on a nonprofit basis.

If you are interested in any of these listings, and are not registered, you may apply by letter or résumé and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 per cent of the first year's salary if a nonmember, or 4 per cent if a member. Also, that you will agree to sign our placement-fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include eight cents in stamps for forwarding application to the employer and for returning when possible.

A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for nonmembers, payable in advance.

NEW YORK	CHICAGO	SAN FRANCISCO
8 West 40 St.	84 East Randolph St.	57 Post St

Men Available[1]

Engineering Executive, BS, MS, registered PE; 33; five years general manager concentrating at times on sales, engineering design, and production of process equipment. Desires position allowing exploitation of inherent potential, versatile background. Decisive, forthright, and good organizer. Location immaterial. Me-669.

Manufacturing Engineer, BSIE; 45; last five years general manager of national metalworking concern; previous ten years in various production capacities prior to five years design engineering; can handle all manufacturing aspects including industrial relations. Location immaterial. Me-670.

Mechanical Engineer, BME; 33; six years' varied engineering experience with locomotive builder. Best suited for production, administrative, or marketing engineering. Rated high for initiative, perseverence, industry, leadership, and business consciousness. Prefers East or Midwest. Me-671.

Assistant Plant Engineer, Mechanical; 28; engineer-in-training certificate in N.Y.S.; one and one half year as fire-protection engineer, one year in technical sales, four years electronics in service. Desires position as assistant plant engineer or leading to plant management. Location optional. Me-672.

Product or Organization Development and Design Engineer, MSME, PE; line or staff administration of product or organization problems. Skilled in personnel development, procurement, or improvement; product development geared to user needs and markets. Appliances, machinery, equipment, structures, laboratories. Over 20 years broad, productive output. Me-673.

Mechanical Engineer, BSME, PE Pa.; 40; inventions, machinery and equipment development, and design. Presently consultant on automation, six years textile, five years steel plant, five years steam turbines. Prefers eastern U. S. Me-674.

Stainless and Heat-Resistant Alloy Specialist; 20 years' experience in metallurgical field. Now working for A-1 company in N. Y. area. Will relocate. Me-675.

Mechanical Engineer, BSME, PE; 36; ten years'design and project experience in mechanical and chemical plant and equipment. Excellent background, record, leadership, versatility, professional competence. Responsible position only. Prefers Cleveland, San Francisco, or equivalent. Me-676-916-Chicago.

Mechanical Engineer, Design and Development, or Machine Design, ME; 46; 26 years' progressive experience from apprentice, toolmaker, machine design, chief tool designer, production engineer, chief production engineering manager subcontracting, engineering manager research and development. Available June 1, 1959. Me-677-921-Chicago.

Industrial-Management Engineer, BSME; 29; three and one half years superintendent overhaul, modernization of naval combatant ships; four years in manufacturing engineering, methods and planning, systems and procedures, wage rate, quality control with electrical-electronic industry. Prefers overseas; will consider anywhere in U. S. Me-303-San Francisco.

Engineering Project Manager, BSME; 38; 14 years in design of electromechanical devices; experimental equipment on nuclear accelerators; microwave-tube fabrication; high-vacuum equipment; high-vacuum, high-temperature furnaces. Prefers San Francisco Bay area. Me-409-San Francisco.

Director of Sales or Director of Business Development in a university, BS and two and one half years graduate work in physics; 53, 11 years sales and promotion of aircraft, missiles, and research and development, 12 years of design, development, and administration in engineering aircraft and missiles. Prefers West, Southwest, or New England. Me-519-San Francisco.

[1] All men listed hold some form of ASME membership.

Positions Available

Mechanical Engineer, MSME preferred, but BSME with extensive experience is acceptable. Training in machine design with emphasis on applied kinematics required. Will direct technical supervision over all mechanical design and production release work. Experience should include three to five years minimum of design and development work on electromechanical devices typical of office-equipment machinery. $8000–$12,000. Company pays placement fees. Conn. W-6706 (*a*).

Development Engineer, graduate mechanical, applied mechanics or machine-design major; eight to 12 years' experience in the steel industry, related to the operation and maintenance of continuous rod, merchant, and billet mills. Work will include analysis, engineering, and test work; production design, etc. Company manufactures continuous rolling mills and allied equipment for steel industry. About $10,000. Northeastern U. S. W-6711.

Administrative Engineer, mechanical graduate, at least ten years' office-engineering experience covering preparation of reports, specifications, standards, and application of residential heating equipment. $10,000–$12,000. New York, N. Y. W-6724.

Engineering Manager, graduate mechanical, to take complete charge of all the engineering involved in a large retail store operation. Construction, maintenance, plant engineering, etc. Salary high. South. W-6727

Industrial-Engineering Manager, graduate, all-around management experience in industrial engineering and sound time-study experience. Will overhaul existing standard-time, incentive system; co-ordinate with production control, cost control, manufacturing, and methods. Must develop and set up program of standard data for thousands of rates; develop task cards for information and control, etc. $12,000–$13,000. Pa. W-6742.

Designer qualified to lay out and design small part machinery; must have background in design of sewing machines for material or leather or both. Knowledge and past experience of sewing machine industry important. Salary open. West coast of Fla. W-6743.

Chief Mechanical Engineer, preferably mechanical graduate, at least ten years' design and product-engineering experience on tools, appliances, or allied equipment. $15,000–$20,000. Midwest. W-6744.

Sales Manager to head up industrial sales division of a filter manufacturer. Must have some experience in rotary vacuum filters. Some travel. About $10,000. Headquarters, Northern N. J. W-6746.

Plant Manager for a firm manufacturing institutional furniture and case goods. Must be experienced production man who can take over and conduct plant as top man. Experience in furniture or related fields desired but will consider man with general metal experience. Salary open. New England. W-6755.

Senior Methods Engineer, graduate in industrial or mechanical engineering; competent in both theory and application of predetermined time values (MTM) and five or more years' experience in application of industrial-engineering principles and practice. Will establish a methods department for company, supervise two or more engineers, co-ordinate methods work, etc. Salary open. Minimum travel. South. W-6767.

Vice-President and Division Manager, graduate engineer, training in ceramics, specifically refractories. At least 10 years in high executive responsibility in the commercial as well as the technical aspects in the manufacture of refractories. $30,000–$35,000. Headquarters, New York, N. Y. W-6770.

Senior Industrial Engineer, BS industrial engineering or management; or ME degree with practical experience in industrial engineering. Three to five years' intensive industrial-engineering experience, preferably in heavy process industry including the paper industry. Experience should have emphasized the determination and application of standard data. Duties will include time study, development of machine-capacity standards, work methods, material-handling studies, and recommendations, etc. $7000–$8000. Central N. J. W-6771.

Design Engineers, mechanical, degree or equivalent, registered engineers or qualified to take examination and obtain registration; minimum of four years' experience. (*a*) For design work for chemical, process, or industrial plants. (*b*) For design work for heating, ventilation, air conditioning, and plumbing for commercial, office, apartment, school, and hospital buildings. $7800–$9600. Company will pay part of fee. Ga. W-6776.

Plant Manager to manage plant of about 20 people engaged in the manufacture of plastic contact lenses. Must be able to manage personnel and help in the design of mechanical equipment in connection with plastic lenses, although experience in contact lenses is not necessary. $10,000. New York, N. Y. W-6779.

Factory Manager, mechanical or chemical-engineering graduate, manufacturing experience in paper or plastic coatings, to take charge of coated-plastics plant. $15,000. New England. W-6780.

Assistant or Associate Professor in Mechanical Engineering, Master's degree required, PhD desirable. Opportunity for directing graduate and research work with expanding school of engineering. Rank commensurate with experience. $6600–$8500. South. W-6782.

Designer, mechanical graduate, at least three years' design and development experience on industrial or deep well centrifugal pumps. $7000–$8000. Midwest. W-6789.

Design and Development Engineer, graduate mechanical, heavy experience in the design and development of automatic wrapping and packaging machinery. $12,000–$15,000. Company will pay placement fee. New York, N. Y. W-6790.

Supervisor, Automation and Instrumentation Applications, degree in mechanical or electrical engineering, five years' experience in control and instrument applications. Duties will entail the analysis and design of servomechanisms and control applications for high-speed production machinery in the fields of metal, paper, glass, and plastics as used in making packaging and canning containers and flexible packaging materials; these machines require hydraulic, pneumatic, and/or electronic control devices. Ill. W-6803.

Nondestructive Test Specialist, graduate mechanical or metallurgical engineer or equivalent experience, heavy experience in welding and radiography. General knowledge of nondestructive testing such as liquid penetrant, magnetic particle, and ultrasonic methods desirable. Extensive travel. To $9000. Company pays placement fees, relocation expenses. Western Pa. W-6809 (*a*).

Stress Analyst, BSME, experienced in thermal shock, thermal and mechanical stress analysis and design, preferably related to high pressure, high-temperature heat-exchanger, and pressure-vessel equipment, etc. Five to ten years' experience. Salary open. Company pays placement fees and relocation expenses. Western Pa. W-6810 (*a*).

Plant Superintendent for Foundry. Must have had experience in cast iron pipe by metal-molds processes. Salary open. Company will negotiate placement fee. N. J. W-6816.

Manufacturing Manager for company manufacturing lighting equipment. Must be experienced in sheet-metal finishing and forming and be strong in production control. Will have 400 employees under supervision. $20,000–$25,000. New York metropolitan area. W-6818.

Technical Secretary for a Trade Association; prefer recent graduate mechanical engineer who has completed military obligations. Excellent opportunity for professional development and advancement. Best working conditions, fringe benefits. Considerable travel. Salary open. East. W-6824.

Process Engineers, degree in mechanical, electrical, or metallurgical engineering, with some work experience related to metalworking preferred. Should have a minimum of four to five years of industrial experience. Company is specialist in the development and manufacture of nickel-chromium and nickel-copper resistance wire, strip and special castings. Salaries open. New York metropolitan area. W-6829.

National Sales Manager, preferably graduate mechanical, for company manufacturing electronic automation equipment. Some experience in the automobile industry desirable or experience in the heavy conveyer or material-handling equipment fields. $15,000–$20,000. Midwest. W-6830.

Design Engineers, Machine-Pressure-Vessel Cement Kiln, with considerable experience in this field. Top salaries, no income taxes; one month paid vacation per year; paid transportation for applicants and family. Apply by letter giving complete résumé including salary desired. Caribbean area. F-6832.

Engineers. (*a*) Administrative engineer, degree preferred; ability to supervise and organize machine-product design (tool and processing) electronic and laboratory sections. Salary commensurate with education and experience. (*b*) Chief tool designer experienced in customer contact. Ability to supervise design and processing groups. $8000–$10,000. Mass. W-6837.

Field Editors for Trade Publication. (*a*) Graduate mechanical engineer, approximately five years' experience in aircraft-design work. Need not have previous editorial experience. $8000–$10,000. (*b*) Graduate mechanical engineer, five to eight years' experience in machine tool, heavy rolling mills, or other steel-industry design experience. Need not have previous editorial experience. $10,000–$12,000. Ohio. W-6841-C.

Design Engineers, some knowledge of pressure or hydraulic-sensing devices or company manufacturing aircraft-pressure switches. $7800–$9000. Lower Conn. W-6843.

Chief Design Engineer, graduate, at least ten years' supervisory design experience in power-plant, distribution, and construction fields. Must speak Spanish; previous responsible position in Latin America. Mexico. F-6847.

Project Engineer for Pressure Transducer and Sub Systems, graduate electrical or mechanical engineer, three to ten years' experience and detailed component knowledge in fields of free displacement, or force-balance-types of pressure transducers, and their combination with servos, mach meters, and true airspeed devices. Will supervise group of engineers, designers, and technicians in research and development, product refinement, test-equipment design, and environmental testing. $10,000–$13,000. Placement fee and moving expenses negotiated. Long Island, N. Y. W-6849 (*a*).

Chief Product-Design Engineer, graduate mechanical, at least five years in heavy machinery, design, and development. Will head up engineering department on design and development for manufacturer of earth-moving equipment. Good potential. $12,000. Employer may negotiate fee. Ill. C-7109.

Nuclear Engineer, BS or MS in mechanical or chemical engineering, or physics, at least training or experience in nuclear reactor technology, for research in this field. Must be U. S. citizen. $10,200. Southern Calif. S-3842(*a*).

Chief Design Engineer, Industrial Plants, preferably graduate mechanical or electrical, minimum of ten years' experience in design and estimating for large industrial plants; including mechanical and electrical power, for base metal plants, mills, concentrators, smelters, and refineries. Will co-ordinate mechanical, electrical, civil, and process engineering. Salary open. Western U. S. S-3904-R. Revised.

Assistant Plant Engineer, Transit Pipe, recent graduate mechanical, to assist in plant layout of mechanical services, equipment, and machinery in new pipe-plant construction. Able to draft help in field work and assist plant engineers in routine and special duties. $5400. Calif. S-3944.

Senior Mechanical Engineer for research and development on small mechanisms and missiles propellant, eight to 12 years' experience with chief or assistant chief responsible on research and development projects relating to small precision mechanisms, instrumentation, and system development. $10,000–$14,000. Must be U. S. citizen; Clearance required. San Francisco East Bay. S-3954(*a*)-R.

Sales Engineer, Steel Products, mechanical, civil, or structural, no degree required but college training necessary; minimum of three years' direct sales experience in construction or metal products. Work involves design, estimating, working with blueprints; will deal with agencies of Federal Government and with prison boards. Travel in State of California and occasionally in adjoining states. $7200–$9000; plus car. S-3955.

Data-Collection Engineer, Reduction-Missiles, degree plus heavy mathematics, minimum of five years' experience data collection and reduction with ability to determine malfunction and capability of redesign of existing equipment for improved operations. Strong on methods and theory, highest capabilities in handling involved data. Need one for servo electronics, experienced in analysis and very good in math; one for test instrumentation. U. S. citizens. Interview and moving expenses paid. $9000–$15,000. Northern Calif. S-3963-R.

Assistant Plant Engineer, plumbing fixtures, graduate mechanical, one to three years' experience related to material-handling furnaces and machinery, for drafting, estimating, installing machinery motors, and structures in foundry and enamelling plants. $6000–$7200. San Francisco East Bay. S-3963.

Systems Engineers, Postal Machinery, Services, experienced in work measurements, methods studies, services, to develop new improved systems, new concepts and design of equipment, mail handling, sizes on postal service, analyze information. (*a*) Graduate mechanical, electrical, or physics, good statistician or mathematician, five to ten years' experience, strong on statistical work, analysis, evaluation, maintenance of information. (*b*) Graduate mechanical, electrical, or physics, five to ten years' experience, primarily in analytical work, applied mechanics, circuit experience, some computer experience desirable. $8400–$12,000. San Francisco Peninsula. S-3966.

Senior Industrial Engineer, Postal Services, graduate mechanical or electrical, who has gone into industrial work. Should be experienced in human engineering, work measurements, methods studies; to develop new improved systems, new concepts and design of equipment for postal service, work closely with postal employees, co-ordination (not time study). $8400–$12,000. San Francisco Peninsula. S-3967.

Administrative Assistant to Chief Engineer, preferably graduate mechanical, electrical, or metallurgical engineer, at least 10 years' supervisory experience in design, estimating, or operation phases of metal-mine plants, mills, concentrators, smelters, or refineries. Will be responsible for engineering-department personnel, cost control, and special assignments or studies. $12,000–$14,000. Western U. S. S-3967-R.

Sales Engineer, Insulation Covering, mechanical graduate or equivalent, recent graduate to five years' experience contacting commercial, public, and industrial users of insulation covering for miscellaneous pipe poles, duct work, able to take off from plans and quote, supervise installation, and work with subcontractors. $5400–$7200, plus bonus, car furnished, fringe benefits. San Francisco Bay area. S-3969.

Mechanical Design, Heating, Ventilating, Piping, preferably graduate, three years' or more experience on plans, specifications, and details for plumbing, heating, ventilating, and piping related to industrial and commercial buildings, schools, etc. $3–$4 per hr. Permanent. San Francisco. S-3972.

Designer, mechanical engineer, BS or MS, security clearance, for new department of nucleonics with well-established company. Should have experience in stress analysis and vibration control, fluid mechanics, and remote control with servomechanisms. Salary open. Northwest. S-3975(*a*).

Chief Draftsman, electromechanical graduate, substantial recent experience directing large drafting room providing services to research, design, development for tubes, electronics circuitry, mechanical arrangement, production, and field engineering for a manufacturer of major computer-accessories equipment. $12,000. Southern Calif. S-3986.

Production Engineer, Electromechanical, graduate mechanical or industrial, well experienced in providing direction and supervision to planning, scheduling, production controls, layouts in large-scale precision assembly operation, including electronic and mechanical components and assemblies. $8000. Southern Calif. S-3987.

Inspection Engineer, Tubes, graduate mechanical, at least two to six years' experience in manufacturing field associated with design or inspection of jigs, fixtures, dies, gages, etc. Knowledge of mechanical tolerances. Develop inspection criteria relative to dimensions, alignment, construction, and visual appearance of vacuum-transmitting tubes. Quality-control experience not necessary. To start, $6000–$9000, depending upon experience. San Francisco Peninsula. S-3989.

OBITUARIES

Samuel Warren Andrews (1890–1956), president, H. G. Acres and Co., Niagara Falls, Ont., Canada, died in 1956 according to a notice recently received by the Society. Born, Lead, S. Dak., Sept. 24, 1890. Parents, William and Elizabeth Andrews. Education, ME, Cornell University, 1912. Married Fonta Kidwell, 1915; children, Francis E. and Dixie Jean. Mem. ASME, 1926. Mr. Andrews had been with H. G. Acres and Co. since 1924. He had been a member also of AIEE and EIC.

John Richard Avery (1910–1957), general engineering department, Fire Control Laboratory, Department of the Army, Frankford Arsenal Annex, Philadelphia, Pa., died Nov. 14, 1957. Born, Philadelphia, Pa., July 16, 1910. Parents, George Smith and Emma (Delp) Avery. Education, BS(ME), Pennsylvania State College, 1931. Assoc. Mem. ASME, 1932; Mem. ASME, 1952. Mr. Avery was a member also of Pi Tau Sigma and Sigma Tau. Survived by his widow.

Edgar Enos Brosius (1877–1957), retired owner and president, Edgar E. Brosius, Inc., Sharpsburg, Pa., died July 9, 1957. Born, Alliance, Ohio, Jan. 26, 1877. Parents, Enos and Jane (Wanzer) Brosius. Education, attended Mount Union College. Married Mary Sharer, 1900. Mem. ASME, 1918. Mr. Brosius had served in the Spanish American War. He was the inventor of various types of grab buckets, furnace charging machines, and a number of other items totaling more than fifty. He had founded his own business in 1909.

Percy Brown (1872–1958), retired owner, Designs, Inc., North Bergen, N. J., died Aug. 1, 1958. Born, Leeds, England, Sept. 14, 1872. Parents, Walter and Mirian (Barnes) Brown. Education, ICS. Married Lena Marggraff, 1896 (died 1953). Mem. ASME, 1916. Survived by a son Percy M. Brown.

Frank Horace Browning (1882–1958), retired engineer examiner, City of Seattle Civil Service Commission, Seattle, Wash., died July 27, 1958. Born, Windsor Locks, Conn., Oct. 8, 1882. Parents, John Wells and Mary Elizabeth (Oviatt) Browning. Education, ME, Lehigh University, 1905. Married Lillian Weymouth Morrow, 1907; children, Janet W. and Frank H. Mem. ASME, 1914. Mr. Browning held a patent for a vortex separator for the removal of dirt and moisture from steam and other gases. He was the author of a pamphlet on the operation of steam boilers and an article on the action of ocean waves.

Clifford Charles Casad (1930–1958), design engineer, Boeing Airplane Co., Seattle, Wash., died Sept. 25, 1958. Born, Bremerton, Wash., May 13, 1930. Education, BS(ME), State College of Washington, 1957. Assoc. Mem. ASME, 1957.

Lee Sherman Chadwick (1875–1958), retired president and chairman of the board, Perfection Stove Co., Shaker Heights, Ohio, died Sept. 16, 1958. Born, East Braintree, Vt., Feb. 26, 1875. Parents, Eugene H. and Emeline Sarah (Farnsworth) Chadwick. Education, BS(ME), Purdue University, 1899. Married Ethelyn Pearl Rogers, 1900. Assoc. Mem. ASME, 1899; Mem. ASME, 1909. The Perfection Stove Co. was the successor of the Cleveland Metal Products Co. of which Mr. Chadwick had been president from 1921–1925. Perfection Stove was organized in 1925 with Mr. Chadwick as president. He became chairman of the board in 1945, and retired in 1951. He held over 150 patents. He was among the first builders of 2, 4, and 6-cylinder gasoline automobile and marine gasoline engines. Mr. Chadwick was a pioneer automobile builder having built two cars in Boston in 1899. Chadwick cars held many race and hill-climbing records. He designed and built early supercharges for gasoline engines.

William Harrison Cline, Jr., (1922–1958), assistant development engineer ,Hughes Tool Co., Houston, Texas, died Sept. 6, 1958. Born, Tulsa, Okla., April 13, 1922. Education, BS, Texas A&M College, 1948. Assoc. Mem. ASME, 1950; Mem. ASME, 1956. Mr. Cline was a registered professional engineer in the State of Texas. He held numerous patents and was the author of a paper on a fluid actuated rotary percussion engine. He had participated in ASME activities in the South Texas Section and the Petroleum Division. He was a chairman of the Manufacturers Committee of the Petroleum Division in 1957, and was slated to be chairman of the South Texas Section Program Committee until ill health intervened. He is survived by his widow, Marilynn, three daughters, Laura Lee, Carolyn, and Mary Louise; and his parents, Mr. and Mrs. W. H. Cline.

Robert Burdette Dale (1884–1958), consulting engineer, Jamaica, N. Y., died July 25, 1958. Born, Cedar Rapids, Iowa, Sept. 30, 1884. Parents, George and Ruth Ann (Doty) Dale. Education, BS(ME), Iowa State College, 1907; graduate study at the State University of Iowa. Married Bertha Martha Hubner, 1908; one son, Robert B., Jr. (died 1932). Mem. ASME, 1917. Mr. Dale held two patents on casting pipe centrifugally, and a patent on a fuel-oil system for engines. He was the author of "Arithmetic for Carpenters" and "Drawing for Builders," both published by John Wiley & Sons. Mr. Dale had been head of the department of mechanical engineering at Pratt Institute from 1925–1942. In 1944 and 1945, he was with the War Production Board as a management consultant for the Labor and Management Division. He was a member also of SPEE and the AMA. Survived by his widow.

Paul Diserens (1882–1958), retired director of research and engineering construction, Worthington Corp., Harrison, N. J., died Oct. 6, 1958. Born, Cincinnati, Ohio, Jan. 9, 1882. Parents, Albert D. and Mary (Jefferies) Diserens. Education, BS, Purdue University, 1904; ME, 1908. Assoc. Mem. ASME, 1908; Mem. ASME, 1916; Fellow ASME, 1943. Mr. Diserens had been with Worthington since 1928 at which time he was chief consulting engineer. During World War II he was a consultant with the National Defense Research Commission. He returned to Worthington in 1945 and took the research post which he held until his retirement in 1953. While at the university, Mr. Diserens was a research assistant with W. F. M. Goss and later was in charge of locomotive tests for Dr. Goss's study of superheated steam in locomotive service under the patronage of the Carnegie Institution in Washington, D. C. Mr. Diserens was the inventor of expander engines for refrigeration in the gasoline industry, valves for compressors and hot oil pumps of various types for oil refineries. He was the holder of many U. S. and foreign patents in his field and wrote a number of papers on compressors, the gasoline and oil industry, and so on. He was the author of the section on air and gas compressors in Marks' "Mechanical Engineers' Handbook." Member also of the American Society of Refrigeration Engineers, and the United States National Committee of the International Electrotechnical Commission.

Charles Andrew Flynn, Jr. (1911–1958), general manager, Jacobsen Metal Products Co., Brooklyn, N. Y., died Oct. 14, 1958. Born, New York, N. Y., Sept. 19, 1911. Parents, Charles A. and Katherine E. Flynn. Education, ME, Cornell University, 1933. Married Elizabeth Andrews, 1937; one son, Charles A., III. Mem. ASME, 1946. Survived by his widow.

Vivian Walter Hoxie (1879–1952), whose death in October, 1952, was recently brought to the attention of the Society, had been retired, and was formerly with the marine department, The Babcock & Wilcox Co., Pacific Coast Division, San Francisco, Calif. Born, San Rafael, Calif., June 3, 1879. Parents, Joseph and Parthenia Ann Hoxie. Education, Healds Business College, 1895; University of California, 1902. Married Grace Arrington Taggart, 1093; children, Grace, Vivian, Mary Jane, Arrian, and William W. Mem. ASME, 1915. Mr. Hoxie had been in full charge of all marine installations on the Pacific Coast for B&W and for C. C. Moore and Co. from 1925–1943. He was a registered professional engineer in the State of California. He was a member also of SNAME and the American Society of Naval Engineers.

John Ralph Jackson (1886–1958), retired, formerly with the Association of American Railroads, died March 6, 1958. Born, Fort Wayne, Ind., May 5, 1886. Parents, Thomas and Anna R. (Chandler) Jackson. Education, BS(ME), Purdue University, 1910; ME, 1915. Married Florence Mae Hopley, 1917. Assoc. Mem. ASME, 1915; Mem. ASME, 1922; Fellow ASME 1947. Mr. Jackson had been with the Association of American Railroads from 1946 to his retirement in 1951. Previously he had served the Santa Fe Railroad, 1910–1917; and the Missouri Pacific, 1925–1946. During World War I he was a captain in the U. S. Army serving 12 months in France. He was the author of several papers on the subjects of railroads. He held two patents covering steam locomotive draft appliances. Mr. Jackson served the Society on a local and national level. He was chairman, 1932–1933, St. Louis section. He served the Railroad Division as a member, General Committee, 1932–1938; Executive Committee, 1938–1942; chairman, 1943. Survived by his widow.

Robert Forney Knox (1928–1958), design engineer, aircraft gas-turbine division, General Electric Co., Cincinnati, Ohio, died Aug. 14, 1958. Born, Oklahoma City, Okla., Oct. 18, 1928. Son of Milton H. Knox. Education, BS(ME), Louisiana State University, 1951. Assoc. Mem. ASME, 1951. Mr. Knox served in the U. S. Air Force for two years as an electronics officer. The Society awarded Mr. Knox a certificate of merit for his entry in a contest to find a slogan for its 75th anniversary celebration. His slogan, "75 Years of Engineering Progress," was judged best from ASME Region VIII.

Willis Cary Lincoln (1891–1958), district manager, Joshua Hendy Iron Works, New York, N. Y., died Sept. 10, 1958. Born, Binghamton, N. Y., Feb. 1, 1891. Education, BE, Union College, 1911. Mem. ASME, 1944. Mr. Lincoln joined the Pomona Pump Co. in 1941. In 1943 that company was purchased by Joshua Hendy Iron Works, and Mr. Lincoln remained with them as district manager. He had been the author of much literature on pumps.

S. Clifford Merrill (1896–1958), assistant general manager, Automotive Division, Timken Roller Bearing Co., Detroit, Mich., died Sept. 20, 1958. Born, Montreal, P. Que., Canada, Feb. 13, 1896. Education, ME, Columbia University, 1917. Assoc. Mem. ASME, 1918; Affiliate ASME, 1923; Mem. ASME, 1930. Mr. Merrill was a member also of SAE and the Engineering Society of Detroit. Survived by his widow, Jean.

James R. Qualters (1924–1958), plant manager, Chicago Division, Townsend Co., Chicago, Ill., died June 2, 1958. Born, McKeesport, Pa., March 4, 1924. Parents, Joseph T. and Isabelle M. Qualters. Education, BS(ME), Pennsylvania State University, 1949; was attending Illinois Institute of Technology for master's degree in business management. Married Elizabeth A. Malloy, 1948. Assoc. Mem. ASME, 1949. He was a veteran of World War II and the Korean War. Survived by his widow and six children, Irene, James, Richard, William, Thomas, and Elizabeth.

Robert Sibley (1881–1958), president, East Bay Regional Parks, Berkeley, Calif., and a former vice-president of the Society, died July, 22, 1958. Born, Round Mountain, Ala., March 28, 1881. Parents, Robert Pendleton and Susie (Bolling) Sibley. Education, BS, University of California, 1903; EE, 1922; graduate study under Harris J. Ryan and Dexter S. Kimball at Stanford University. Married Catherine Stone, 1904 (died 1942); daughter, Catherine. Married 2nd, Carol Rhodes Johnston, 1943. Mem. ASME, 1912; Fellow ASME, 1936. Mr. Sibley had a long and varied engineering career as an educator, an editor, and an administrator. He was the dean of the engineering school and professor of mechanical and electrical engineering at the University of Montana; professor of mechanical engineering at the University of California. He was editor of the *Journal of Electricity* and *Western Industry* and president of the McGraw-Hill Co. of Calif. In 1923, he became executive manager of the California Alumni Association, the largest organization of its kind in the world. He was also head of the American Alumni Council. a policy-making body for 7 $^1/_2$-million college graduates and former students. A specialist on world power statistics, Mr. Sibley had traveled extensively and studied industrial and power development throughout the world. Mr. Sibley was an official ASME-AIEE representative at the first World Power Conference in London, 1924; represented ASME and the U. S. Government at the Second World Power Conference in 1930; and the interim meetings of the World Power Conference in 1933. At the invitation of Albert Einstein, Mr. Sibley assisted in efforts to promote international control of the atomic bomb and constructive uses of atomic energy in 1946. He was the author of a number of articles for the technical press, as well as the following books: "Fuel Oil and Steam Engineering," "Romance of the University of California," "America's Answer to the Russian Challenge," "The Golden Book of California," and others. He was a director and first vice-president, Fidelity Building and Loan Assoc.; president and director, Fidelity Acceptance Corp.; and chairman of the board, Bank of Berkeley. He served the Society as a vice-president, 1921–1923, and was twice chairman of the San Francisco Section of ASME. He was a member also of AIEE, Sigma Xi, and Tau Beta Pi. Survived by his widow.

Walter Irvine Slichter (1873–1958), professor-emeritus of electrical engineering, Columbia University, died Oct. 14, 1958, at his home, Schenectady, N. Y. Born, St. Paul, Minn., May 7, 1873. Parents, Henry Clay and Lettie (Irvine) Slichter. Education, attended College of the City of New York; EE, Columbia University, 1896. Married Mabel Ostron, 1903. Assoc. Mem. ASME, 1902; Mem. ASME 1912; Fellow ASTM, 1941. From 1912 until his retirement in 1941, Professor Slichter was head of the Department of Electrical Engineering at Columbia. After his retirement he remained at Columbia as a special lecturer in his field until 1946. A specialist in alternating current, motors and systems, and an authority on the economics of power, he had designed electrical machinery. In World War I he supervised the installation of electric turbines on U. S. battleships. He also headed a special Radio Officers Training School at Columbia in 1918. In 1894, before graduation from Columbia, Professor Slichter joined the General Electric Co. as a cadet in engineering and became a student of Charles P. Steinmetz. He acted as assistant to Dr. Steinmetz until 1905. That year he became an engineer in G-E railway and traction department. In 1909 he was named consulting engineer. He was associate editor of "Pender's Handbook of Electrical Engineering," and of "Peele's Handbook of Mining Engineering." Professor Slichter was a past-manager, vice-president, and treasurer of AIEE. He was chairman of the Library Board of the United Engineering Societies. He was a member also of SPEE, AAAS, Sigma Xi, and Tau Beta Pi. Survived by his widow; a daughter, Mrs. Robert B. Beale, Jr., Louisville, Ky.; and two grandchildren.

Earle Lewis Swanson (1921–1958), project engineer, American Wheelabrator Corp., Mishawaka, Ind., died Oct. 2, 1958. Born, La Porte County, Ind., July 22, 1921. Parents, Edwin and Minnie (Hildebrand) Swanson. Education, attended La Porte Business College, 1939; BS(ME), Purdue University, 1946. Married Nacille Schmidt, 1945. Mr. Swanson had been with The Northern Indiana Public Service Co., the U. S. Slicing Machine Co., and the Bendix Guided Missile Plant, before joining the Wheelabrator Corp. in 1956. Member also of Pi Tau Sigma and Tau Beta Pi. Survived by his widow; and two sons, Zane Lewis and Ned Joel.

Bruce Bastress Watson (1898–1958), chief inspector, test department, The Pennsylvania Railroad, Altoona, Pa., died Sept. 14, 1958. Born, Sunbury, Pa., Dec. 10, 1898. Education, BS(ME), Pennsylvania State College, 1921. Mem. ASME, 1944. Mr. Watson joined the Pennsylvania Railroad in 1921. He held a patent with W. M. Keller for a belt guard for protection of car lighting axle generator belts on railroad cars. Survived by his widow, Mable S. Watson.

John D. Webster (1888–1958), assistant engineer, sales department, Ebasco International Corp.. New York, N. Y. died in Englewood, N. J., May 27, 1958. Born, Edinburgh, Scotland, Dec. 6, 1888. Parents, James and Agnes (Dickson) Webster. Education, Heriot Watt, Edinburgh University. Married Laura Currine, 1920. Mem. ASME, 1922. Mr. Webster had been the recipient of the Carnegie Scholarship and Medal from Heriot Watt Edinburgh. Survived by his widow and two children, John D. Webster and Laura Eloise Wallis.

Thomas Rote Weymouth (1876–1958), consulting engineer and leader in the development of the natural gas industry, New York, N. Y., died Sept. 23, 1958. Born, Lock Haven, Pa., March 16, 1876. Education, BS(EE), Massachusetts Institute of Technology, 1897. Married Josephine Goettel (deceased). Mem. ASME, 1910; Fellow ASME, 1936. Mr. Weymouth was a vice-president of the Columbia Gas System, Inc., from 1930–1941. He had been president before that of a number of leading companies in the natural gas industry, among them the Iroquois Gas Corp., the Oklahoma Natural Gas Corp., and the American Natural Gas Co. He also served as a director of the United Natural Gas Co., the Pennsylvania Gas Co., the Clarion Gas Co., the Pennsylvania Oil Co., and others. He developed the "Weymouth formula" for determining the flow of gas through a pipeline. In 1907 he devised a flatbed truck durable enough to haul 23,000-lb loads in the Pennsylvania oil fields. During World War II, Mr. Weymouth served as a natural gas consultant to the Petroleum Administration for War. In 1941 he received the Charles A. Munroe Award from the American Gas Association. Mr. Weymouth served ASME as a vice-president, 1930–1932. He had also been an active committee worker serving on Special Research Committees on Fluid Meters and Velocity Measurement of Fluid Flow. He was a member also of AIEE and AAAS. Survived by his sister, Mrs. Edward G. Kendall, and a stepson, William Loomis.

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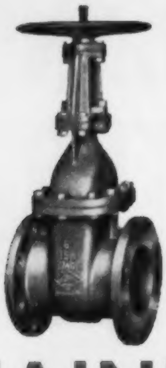
REPRESENTATIVE USERS OF YARWAY WELBOND VALVE: Houston Lighting & Power Co. Jersey Central Power & Light Co. Boston Edison Co. Virginia Electric & Power Co. Connecticut Light & Power Co. City of Independence, Mo. Aluminum Co. of America City of Pasadena, Calif. Mississippi Power & Light Co. Rochester Gas & Electric Corp. Ohio Edison Co. Central Hudson Gas & Electric Corp.



In this **Split Wedge Gate**

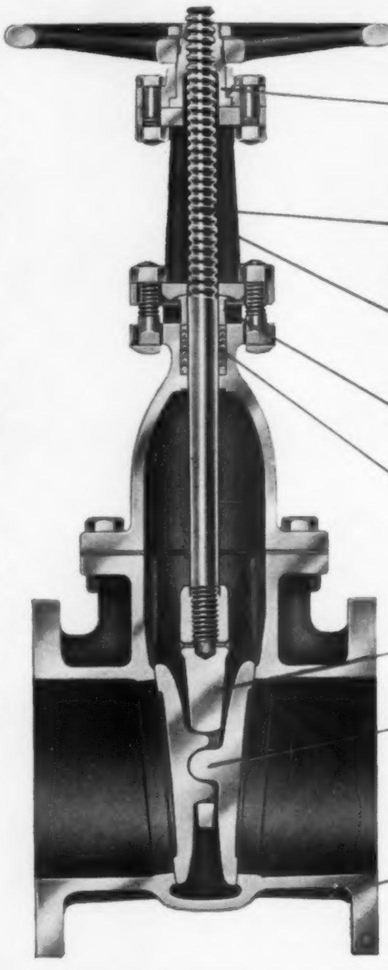
you can see why it pays to

Specify **JENKINS** for STAINLESS STEEL **Valves, too**

This picture shows the many points of excellence in the design and construction of Jenkins Fig. 1327 Split Wedge Stainless Steel Gate Valves. Compare them with any valve you know. You'll conclude that it's hard to beat Jenkins at making valves, no matter what the material.

But no picture can show the quality of the castings . . . the precision machining . . . the rigid inspection and testing that have gone into this valve. All of these are as important as design and metal alloys in assuring long, dependable, economical valve service. And, all of them are up to the peak standards for which Jenkins has been known for almost a century.

SEND FOR NEW CATALOG of Jenkins Stainless Steel Valves. You'll find in it the patterns you want, in a choice of alloys that satisfy the requirements of practically all corrosive services. Also, you'll see that these Jenkins valves meet valve industry specifications and the high standards established by the leading users of stainless steel valves. Jenkins Bros., 100 Park Avenue, New York 17.



WHEEL of high strength malleable iron designed for firm grip and easy operation.

YOKE BUSHING, easily renewable. Made of bronze, for ideal thread engagement with stainless steel spindle, to prevent seizing or galling of spindle threads. Bushing of stainless steel is optional.

SPINDLE has long thread bearing surfaces with correct lead for easy, tight closing. Screws into wedge carrier, then secured by a stainless steel pin.

YOKE BONNET has liberal space between yoke arms for easy access to packing box. Precision machined flange face assures uniform contact with gasket for a tight body-bonnet joint.

GLAND consists of two pieces — gland flange and gland follower — eliminates binding of follower in case gland bolts are tightened unevenly.

PACKING of Chevron-type Teflon in large packing box prevents leakage. Only a minimum load is required on gland, extending service life of packing.

WEDGE CARRIER connects wedge to spindle and raises or lowers it. Husky in size to stand any operating strains.

SPLIT WEDGE is the ball-and-socket design which automatically adjusts to the tapered seating surfaces for positive shutoff. The discs, revolving freely in the wedge carrier, produce a self-cleaning action on seating surfaces and reduce possibility of galling and seizing.

BODY —Through-port design for full, free flow. Ample wall thickness and good design provide extra strength to withstand stresses. End flanges conform to M.S.S. specs.

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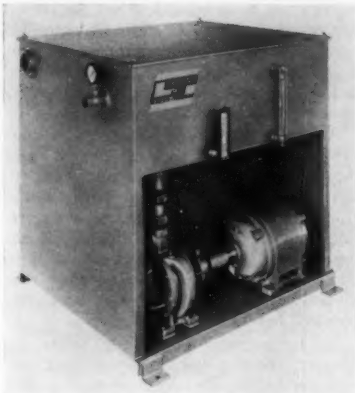
NEW EQUIPMENT



New Packaged Boiler Return Systems

The first modern boiler return system has been announced by Liqui-Therm Products Co. featuring clean, modern lines, with pump, motor and tank a single, compact unit with all gages, valves, vent, and return openings.

The systems are available for operation with boilers from 10 through 100 hp, and pressures up to 200 lb. Special or larger units are available to meet any specific requirement. Three receiver sizes are offered; 50, 80 and 130 gallon tank capacities. Units are furnished either with Turbine-type pump (type "T") or with centrifugal pump (type "C").

The units have extra heavy welded steel receivers, available with Durlon-12 corrosion-resistant lining. —K-1

Immersion Heaters

N. J. Thermex Co., announces a new line of immersion heaters introducing a new vapor venting system designed to eliminate internal explosion in quartz heaters.

The firm says the assembly, called Vapovent, provides a system for venting expanding gases in a completely liquid sealed head assembly.

In addition, the heaters feature a vapor and liquid tight assembly which protects both quartz and steel heater units from damage by accidental total immersion in highly corrosive chemicals. —K-2

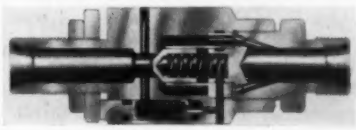
Silicone Rubber

Dow Corning has announced the development of a fast setting silicone rubber, identified as Silastic RTV 502.

The new material is described by the company as being an easy-to-apply liquid which vulcanizes to a rubber in 30 minutes, about 20 times faster than conventional RTV silicone rubbers.

RTV, or room temperature vulcanizing silicone rubbers, have gained acceptance as versatile, basic engineering materials because they offer a fast, simple, low cost method of obtaining rubber-like properties, the firm reports. Silastic RTV 502 retains flexibility from −70 to 500 F and has good electrical insulating properties. Like regular heat-cured silicone rubber, it also resists weathering, moisture, ozone and corona.

The new material is said to be suitable for sealing and calking metal-to-metal and metal-to-rubber joints; potting and encapsulating electrical and electronic parts; as a mold or impression material for making prototype parts; as a shock and vibration absorber for delicate components. —K-3



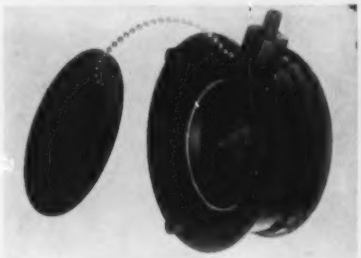
In-Line Relief Valve

Republic Mfg. Co. has announced a 5000 psi in-line relief valve designed primarily for high pressure, high flow, and high temperature applications.

According to the firm, adjustment over the entire range can be made by turning external adjusting nuts without disconnecting either pressure or return line. The unit provides free flow in reverse direction also, the company states.

The design contains only one packing, an O-ring which can be replaced without taking the valve out of the line, the firm says.

The unit is available with either standard 37 deg flare or flareless fittings, in accordance with MS 33656 or MS33514, respectively. It is stainless steel and its standard unit temperature range is −65 to 160 F. Up to 400 F maximum is possible with a special O-ring, the company reports the unit is available in tube sizes 8 and 12. —K-4



Solid Front Gages

A newly designed line of gages for positive protection of personnel in the event of tube failure has been announced by Crosby Valve & Gage Co.

According to the firm, the gages cannot blow out toward the front because a shield is cast as an integral part of the rigid case construction. A full nylon back blows out at case pressures less than 2 psi should tube leak or fail, the company states.

Design features allow full access for adjustment, a sturdy fabricated socket assembly in a wide selection of construction materials, and special wrench grip on pressure connection.

Bourdon tubes are of uniform fine grain and have high elastic limit and low hysteresis valves. The rotary, geared, all stainless steel movement is designed so that errors in angularity may be corrected by pivoting the movement around the pinion axis. —K-5

Readout-Recorder

A militarized two channel readout-recorder for monitoring any servo system, has been introduced by Brush Instruments Div., Clevite Corp.

The new servo monitor simplifies data gathering by providing permanent chart records of angular or displacement data of a servo transmitter, according to the company.

It has been designed for industrial and military applications where the accuracy achievable by an infinitely expanding scale is vital.

Among possible applications listed by the firm are readout for analog computers, extremely high accuracy recording over d-c to 2 cps in research, servo recording, production testing and inspection.

Operation of the servo monitor is automatic. The high speed recorder features zero time flyback. Chart speeds, in a wide range, are 5, 10, 20, 40 and 80 in. per hour. Electric recording, unaffected by ambient conditions, is used on instrument. —K-6

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Continuous Blender

A continuous-flow blender has been developed by Johnson-March Corp. to proportion, mix, blend and discharge a wide range of dry materials, or blend liquids with solids in precise quantities.

The blender, called Verticone, is said by the company to have application in chemicals, ceramics, glass, metals, cement, metal and nonmetallic mining, industrial power plants, paint, plastic and rubber manufacturing, coke plants, steel mills and foundries. The unit acts both as a blender and as a dust preventative, the firm reports.

Materials to be treated or blended are fed proportionately into the unit, via controlled volumetric feeding equipment onto the apex of a cone. This cone causes the material to form a circular, falling curtain as it leaves its base periphery.

At the base of the cone, spray headers can be provided to disperse any desired liquid into the mixture in any proportions required. Liquid is sprayed on the blended dry material from both inside and outside the curtain as it falls onto a retention plate. Further blending of both the solids and liquids is made on the retention plate by mixing blades that automatically discharge the completely blended and treated material.

In applications where only solids are blended, effective and economical dust control can be provided by conditioning with compound MR solution, the company states. This is a surface active compound developed by the firm to keep the fine particles evenly dispersed to prevent segregation in the mix and eliminate dust. Controlled wetting in the blender is achieved with a fraction of one per cent of moisture, or it may be precisely adjusted and metered to add any specific volume of moisture desired, the company reports. —K-7

Weldable Alloy

A new air-hardening, weldable, and fully martensitic alloy has been developed by Carpenter Steel Co. to meet the need for a metal that can be used for highly stressed parts at temperatures up to 1050 F where joining is a problem.

The steel, known as 404 alloy, is designed to be free from weld cracking without preheating or postheating. The firm says weldments can be readily cold worked after stress relieving or annealing.

The new alloy is recommended by the company for applications such as steam turbine buckets, blades and bucket covers, and such casting in assemblies as turbine diaphragms.

It is essentially a 12 per cent chromium $1^1/_2$ per cent nickel composition having relatively high tensile strength and good ductility. In the annealed condition, the steel is said to be easily blanked, drawn, formed, or cold headed. It is claimed to have easy machinability in both treated and annealed conditions. —K-8

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Quick Release Panel Nut

A new commercial quick release panel fastener for use on access doors and removable panels of busses, trucks, trains, and other types of mobile equipment, has been developed by the Elastic Stop Nut Corp. of America.

The firm describes it as an uncomplicated, rugged, two piece fastener, a nut and basket retainer, which is simple to install and virtually foolproof in operation. It does not have springs or pins.

In operation, as the bolt is rotated, the self-locking nut turns from the entry slot of the basket and lifts on the beveled edge of the nut lugs into the basket recess. The lifting action of the nut draws up the screw and attached cover plate into firm, positive contact with the base plate at the desired preset loading, the firm reports. **—K-9**

Electronic Tracer

Simple pencil line sketches of intricate shapes and forms can be used to guide oxygen shape-cutting machines as a result of a new electronic tracer introduced by Linde Co., Div. of Union Carbide Corp.

A built-in automatic kerf compensator makes it possible to reproduce complicated metal parts easily and with extreme accuracy from exact size drawings, the firm reports. Parts can be reproduced without the necessity of making allowance for kerf width on the drawing.

Known as the Photocell Tracer, the new unit has a photoelectric scanning head geared to a steering motor which in turn is connected by means of a geared belt to the drive head. The main control box can be remotely mounted and is connected to the tracing head by a 25-ft multi-conductor cable. A small remote control box can be located to suit the operator's convenience either on the machine or on the tracing table. **—K-10**

Conveyor Idler

A new spiral-shaped rubber idler for belt conveyors has been developed by Hewitt-Robins, Inc., to handle coal, ores, fertilizer, chemicals, coke, aggregates, cement, and other bulk materials.

The new idler, said to be highly flexible and adaptable to any type of belt conveyor, is made of tough synthetic rubber molded around a wire rope.

The company reports the unit has self-cleaning action produced by constant flexing from end-to-end to prevent build-up of wet, sticky materials. Its flexibility enables it to conform to variations in the belt load, thus providing more uniform conveyor operation, the firm states.

Mounting brackets on either end of the idler permit free pivot in the vertical plane with result that idler hangs naturally and conforms readily to off-center loads. **—K-11**

an apology

. . . to those members of The American Society of Mechanical Engineers who have not received their previously requested MECHANICAL CATALOG.

For some years now a print order of 16,500 has been adequate to supply the needs of the Society Members . . . who receive their free copy of the MECHANICAL CATALOG upon written request. Not so for 1959.

We printed the normal 16,500 . . . and promptly received almost 18,000 requests. This enthusiasm for the 1959 edition is heartwarming . . . but embarassing. We filled the orders on a "first come" basis . . . and did our best to placate the latecomers.

As for 1960 . . . we think we have the situation under control. A print order of 18,500 has been placed and we look forward to satisfying all demands for this issue.

Again . . . our apologies to those members not receiving the 1959 MECHANICAL CATALOG

And . . . a request of those who did . . . be a little bit more carefree about lending it . . . just for this one year.

MECHANICAL CATALOG 1959 Print Order. . . 16,500
1960 Print Order. . . 18,500

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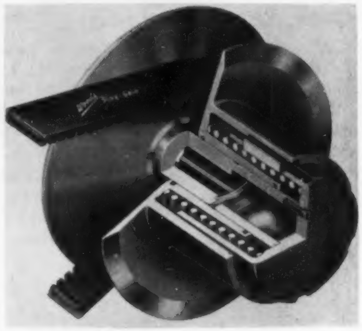

Variable Speed Sheave

T. B. Wood's Sons Co. announces its MS series variable-speed pulleys which incorporate a new design to eliminate corrosion, freezing and sticking.

The firm reports that bearing surfaces are re-oiled from an oil reservoir with each rotation of the pulley. The continuous rotational pumping action of the flange hub on the sleeve constantly renews and evenly distributes the oil film on the bearing surfaces.

There are no keys to obstruct the flow of oil around the surfaces between the flange hub and sleeve, the company states. A series of nylon-faced rubber keys, located outside the bearing surfaces, transmit the power from the stationary to the moving flange through a removable sleeve cap. The torsionally resilient keys carry the belt torque and assure even distribution of the load and equal transmission of power by both flanges. **—K-12**

Vibrating Conveyors

Carrier Conveyer Corp. has developed a new mechanical vibrating conveyor for moving solid granular materials, castings, sand, and tramp iron uphill at inclines of 5 to 25 deg.

The unit has a patented step-trough design, which, the company says, uses hundreds of small steps in the trough to catch the material on the downstroke to prevent it from slipping backward. **—K-13**

Data Recording Paper

A new photo-recording material which extends data-recording capacity of immediate read-out galvanometer oscillographs has been introduced by Eastman Kodak Co.

The new material is an extra-thin-base version of Kodak linagraph direct print paper, introduced earlier this year on a 5-mil base. The new material has a maximum 3-mil base.

Officials point out that the new thinner base for the immediate read-out material will make possible loading of more footage per roll in standard magazine sizes. This means that more data may be recorded in the same time period because of the resulting increase in recording paper capacity. **—K-14**

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Feeder System

Stephens-Adamson Mfg. Co. has announced a continuous weigher and gravimetric feeder system designed to provide extreme accuracy in automatic feedings.

The weigher consists of a circular trough through which pass a series of flights attached to a rotating plate. The firm says these flights convey the material in a positive, continuous flow circularly through approximately 300 deg from the entrance to the exit points.

The pivot axis of the weigher and the entrance and exit points are all in vertical alignment. The control system for the weigher is adaptable to the standard 3 to 15 psi pneumatic air signal control or mechanical systems.

As an added accessory, a recorder can be included to give a record of the flow. Generally, the company says, this will be a 24-hour dial recorder, but a continuous type can be furnished. They can be either electric or springmotor driven and located at a point remote from the weigher. —K-15

Lift Truck Weighing

A 5000-lb capacity weighing attachment for fork-lift trucks, said to be accurate to two-tenths of one per cent of its capacity, is now available on the 3000, 4000 and 5000 lb Clarklift model trucks manufactured by Industrial Truck Div., Clark Equipment Co.

According to the firm, the accuracy of the weighing device makes it practical for such applications as checkweighing receivables, weighing intra-plant shipments, inventory control by weight, batch process weighing, and checkweighing freight shipments. Use of a lift truck mounted weighing attachment reduces travel and eliminates frequent pick-ups and set-downs required when floor scales are used, the company states.

Controls for the device, including weight indicator, are mounted on lift truck steering column within fingertip reach of the operator. The weighing mechanism is mounted between upright and fork plate. There are no mechanical linkages, knife edges, or moving parts in the weighing mechanism. The firm says accuracy of weight measurement is not effected by position of load, even when load is carried on one fork.

The unit utilizes a steel column rather than a spring to support load being weighed. Weight of the load is applied to a steel column in a load cell. The resulting compression is sensed by a strain gage and translated into pound readings on the instrument panel. A zeroing out control permits the operator to discount weight of pallets or containers if only net weight of the load is desired. Circuitry of the device utilizes transistors and condensers and is designed for rugged industrial use. Overload stops protect the system from severe shocks. —K-16

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Speed Control Section

A newly designed speed control valve which can be installed as an integral part of any of its Series CC directional air control valves has been announced by Hannifin Co., Div. of Parker-Hannifin Corp.

This unit, designated as the Speed Control Section is capable of accurate control of cylinder piston speeds by independently metering exhaust flow from both ends of an air cylinder through a single exhaust port in the valve. Supply flow is unaffected by the metering device, the firm states. Adjusting screws have extra fine threads and metering tapers designed to give a wide controllable range without extreme sensitivity. The unit is easily adjusted with an ordinary screw driver.

The speed control section, which is $^5/_8$ in. thick and constructed of corrosion-resistant materials, conforms to JIC recommendations. Installation on a valve in service is accomplished by removing the cap screws that fasten the valve body to its ported base, inserting the speed control section between the body and base, and securing the three components together with longer cap screws provided in the kit. The piping remains undisturbed.
—K-17

Centrifugal Blowers

A line of centrifugal blowers with a wide range of pressures and volumes has been announced by Joy Mfg. Co. Sizes vary from 440 cfm at 1/4 in. static pressure for a single-width, single-inlet fan to more than 460,000 cfm at 16 in. static pressure for a double-width, double-inlet fan.

The blowers are an improved design over backward curved fans, the firm reports. The blades on the new blowers have an air-foil shape which results, according to the firm, in greater efficiency, silent operation and reduced horsepower.
—K-18

Wrought Iron Bars

A full line of 4-D wrought iron bars, rounds and angles is announced as available from A. M. Byers Co. Bars are available in lengths up to 30 ft. Bars and Shapes meet ASTM and AAR specifications. —K-19

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Limit Switch

A new vane-operated limit switch designed to sell for half the cost of most conventional proximity-type switches and which requires no separate power supply, has been introduced by General Electric's General Purpose Control Dept. for use in controlling machinery travel.

Operating life of the new device is expected by the firm to be three times that of lever switches when used with conventional low coil current relays. It is capable of over 250,000,000 operations with the company's static control, according to the company.

Armless, leverless, and shaftless, the new magnetic device is energized by the passage of a separate metal vane through a recessed slot in the switch. Attached to the mechanism to be controlled, the vane disturbs a magnetic field balance which causes two small contacts to operate. Located between two permanent Alnico magnets, the contacts are sealed in inert gas for long life. Effect of normal stray magnetic fields and presence of magnetic dust and chips in the slot will not cause false operation, according to the firm.

Operation of the precision device remains consistent within ± 0.0025 in. providing position of the vane is maintained, the company says. Response time of the switch is approximately 0.001 second.

Rated 115 volts a-c and 0.2 amp make or break, the single-pole, single-throw design meets JIC requirements and is available in normally open and normally closed forms with or without a neon indicating light.

—K-20

Water Heater Controls

A line of gas water heater controls with built-in pressure regulator is being offered by Robertshaw-Fulton's Grayson Controls Div.

The company's standard Unitrols 110, 200, and 400 now are available with pressure regulator in a redesigned, all-in-one assembly. The company believes it is the first controls manufacturer to offer water heater devices equipped with concealed gas pressure regulators.

—K-21

Nickel-Base Alloy

An alloy that combines the advantages of resistance to corrosion with good strength at high temperatures is the subject of a 12-page booklet released by Haynes Stellite Co., Div. of Union Carbide Corp.

Information on Hastelloy alloy B, one of a group of nickel-base alloys bearing this trade mark, has been consolidated in the technical literature. The alloy was developed primarily to offer chemical processors excellent resistance to hydrochloric acid over a wide range of concentrations and temperatures. In addition, alloy B has become a valuable high-temperature material because it retains over two-thirds of its room temperature yield strength at 1600 F.

—K-22

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Small Gearmotors

Allis-Chalmers has announced the addition of a new line of integral gearmotors in both the concentric shaft and right angle types for integral horsepower motors through 100 hp.

Also announced is a line of fractional horsepower integral type right angle gearmotors. The new integral units are available with either open or totally enclosed motors, double and triple reduction in standard ratios.

A one piece, corrosion resistant cast iron housing and rabbet-fit motor flange in the integral gear motors is designed to assure positive alignment of the motor and gears regardless of mounting position. The firm says ratio changes are simplified through use of only one low-speed gear set for each drive size. **—K-23**

Rotary Compressor

Worthington Corp. announces the addition of Model 365 cfm Blue Brute rotary compressor to its line.

According to the firm, the new unit incorporates a unique method of construction that puts the second stage compressor cylinder directly over the first stage. It is equipped with self-draining cylinders and a silent chain drive that is rated for 20,000 hr of life.

The unit also is equipped with two filters, one being a lifetime filter and the other an inexpensive, replaceable final filter. The outboard end of each cylinder is exposed, thus every moving part of the compressor is accessible.

Five automatic controls are designed to eliminate high discharge air temperature engaging the clutch while the engine is running and overheating cooling water. The unit is powered by a Cummins model NHC-400 engine. **—K-24**

Plug-In Limit Switch

An oil-tight roller-plunger operated plug-in limit switch said to offer exceptional adjustment accuracy has been announced by Square D Co.

The new switch features a micrometer adjustment which permits up to $^{1}/_{8}$ in. movement of roller position after the limit switch has been installed. The firm says this feature provides a means of making accurate adjustments without moving the switch itself. The knurled adjusting knob can be marked to assure exact repositioning if the switch setting must be changed.

Roller operating direction can be changed 90 deg to allow for a cam approach perpendicular to the base of the limit switch. The limit switch can be mounted in any one of six arrangements. The new switch is designed to be cammed, and the approach of the cam is not limited to a head-on direction, the company reports. The switch is built to provide dependable operation on applications where camming is from a side angle. It requires $5^{1}/_{2}$ sq in. of mounting space. **—K-25**

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Variable Speed Drive

Roberts Mfg. Co. has announced a hydraulic variable speed drive with motor, reversible, for speeds of 0 to 750 rpm.

In operation, a $1^1/_2$ hp electric motor drives a variable displacement hydraulic pump through silent chain and sprocket, which in turn drives a fixed displacement hydraulic motor.

According to the company, rotation of the handwheel provides infinite speed control to 750 rpm. A reversing level is provided for instantaneous rotational change.

The firm reports the unit is designed for application with lathe heads, reamer drives, conveyors, printing presses, cream separators, garden tractors, midget cars, pumps, blowers, canning machines, milling, test benches. **—K-26**

Cylindrical Square

Brown & Sharpe announces a 6-in direct reading cylindrical square, No. 558, designed to show variations from square in units of .0002 in. directly on the cylinder and eliminate the need for transfer instruments.

One end of the square is precisely ground and lapped out-of-square so that when the cylinder is rotated, its angle with the base surface will at some point match the angle of the work piece and shut out light against the work. Out-of-squareness is then read directly in .0002 in. by following the dotted curve nearest to the top edge of the working piece to the top of the cylinder.

The unit is approximately $2^1/_2$ in. diameter and $6^1/_4$ in. high overall and 6 in. high. Surface finish is 6 rms or better and the diameter is ground and honed to within .0001 in. Ends are ground, lapped, and serrated to reduce friction and decrease inaccuracy from dust. Cylinder is case hardened with clear, black dotted curves and numerals. **—K-27**

Tank Truck Meter

A fully automatic tank truck meter which combines in one unit a crank-control Rotocycle meter, ticket-printing register, combination strainer and air eliminator, and automatic shutoff equipment, has been introduced by Rockwell Mfg. Co.

It is designated the T-70 meter. It weighs 70 lb, operates at 125-psi working pressure, (hydrostatically tested to 250-psi) and accurately measures flow at rates ranging from 14 to 70 gpm. **—K-28**

Miniature Motor

Electro Products Div., Western Gear Corp., announces design of a new miniature motor, Model 2PPl, rated at 1/100 hp at 11,000 rpm.

It has been qualified to MIL-M-8609 specification, the firm reports. The 26.5 volt d-c motor is 1.18 in. diam, 1.9 in. long and weighs $3^1/_2$ oz. Life is 500 hr without change of brushes, the company states. **—K-29**

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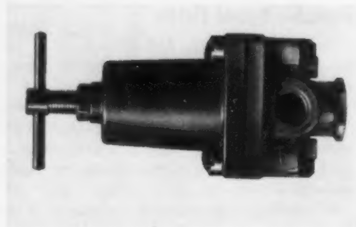

Air Pressure Regulator

A new general purpose air pressure regulator has been announced by Watts Regulator Co.

The Series 112 regulator is said to feature excellent flow capacity and accuracy, and is expected by the company to meet such requirements where larger, more expensive regulators were previously specified as competitively priced air compressors and paint spray rigs.

It is constructed of die-cast zinc, with internal parts of brass, and diaphragm and disk of oil-resistant Buna-N. The valve is available in $^1/_4$ in. size only.

A companion regulator, Series 113, is identical except for a self-relieving feature which prevents pressure build-up in the low pressure system and permits downward pressure adjustment without bleeding the line.

—K-30

Centrifugal Clutch

Development of a new straight centrifugal clutch with only four moving parts is announced by Fairbanks, Morse & Co., Magneto Div.

Two springs and two shoes are the only moving parts. The company says this makes the clutch particularly suitable for applications on motors and small gasoline engines. It can be used to accelerate high inertia loads where smooth starting is essential, gives overload protection in situations where damaging overloads may occur, and it is ideal for pulsating load, the firm states. In addition, it will provide free-wheeling when the prime mover is stopped, and can be used to furnish dual drive from the motor or engine. It is also useful for standby power applications.

Available in capacities from 1 to 15 lb-ft, at from 1400 to 3600 rpm, the straight centrifugal clutch is offered in a choice of 3, $3^1/_2$, and $4^1/_4$ in. OD, with $^7/_{16}$ to 1 in. bore.

—K-31

Line Strainers

Spraying Systems Co. has expanded its range of line strainer capacities and choice of materials.

Strainers are now supplied in a range of threaded pipe connection sizes from $^1/_4$ to 4 in., and with flanged connections for 3, 4, and 6-in. pipe sizes. All strainers are now available in stainless steel as well as in brass and cast iron.

—K-32

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Pillow Block Units

A new high strength, low-cost line of ball bearing pillow blocks has been announced by the Sealmaster Bearing Div., Stephens-Adamson Mfg. Co.

The new line, called the LP series, consists of precision, one-piece malleable units, ready for assembly on the shaft. Each unit is permanently sealed and pre-lubricated with a high-grade lubricant. Available in shaft sizes from $^3/_4$ to $1^7/_{16}$ in. **—K-33**

Car Shaker

Syntron Co. announces a new electromechanical car shaker designed to empty railroad hopper cars ten times faster than manual methods.

The shaker's 4 hp self-lubricating motor produces 850 powerful vibrations a minute for unloading coal, rock, sand, gravel and other hard-to-handle bulk materials. The firm says the unit eliminates rodding and poking.

The shaker is composed of a powerful, totally enclosed vibrating motor mounted on a hook-type steel frame. **—K-34**

Electrical Panels

New raintight, NEMA Type 3R enclosures with interchangeable conduit hubs are now available for all 60-amp series connected and 100-amp parallel connected fuse puller panels manufactured by the Circuit Protective Devices Dept., General Electric Co.

The new series-connected panels are rated 60-amp, 120/240-volts a-c, single-phase, three-wire. They are available with an extra puller and up to 12 plug fuse branch circuits. Neutral provisions include both insulated groundable and grounded.

All parallel-connected panels are rated 100-amp, 120/240-volts a-c, single-phase, three-wire, and are available with up to four pullers and provision for 4 to 12 plug fuse branch circuits. All parallel panels have grounded neutrals. These new devices are listed by Underwriters' Laboratories Inc. **—K-35**

Gate Valve

A new leakproof gate valve which incorporates Teflon seals in the wedge has been placed on the market by Hamer Valves, Inc.

Named the Wedge-Seal, the valve is claimed to mark a radical departure from conventional gate valves. As the wedge is lowered in the valve to a precision metal-to-metal fit against the seats, the Teflon seals on either side of the wedge compress against the seats to form a double sealing action. This action, the company states, enables the new valve to provide a positive shutoff both upstream and downstream, eliminating the need for a double block and bleed in piping installations.

The valve is available in both 150 and 300 lb classes. Remote control valves are also available. **—K-36**

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Hydraulic Power Check

Appco Corp. has introduced a new hydraulic power check designed to provide smooth, precision control of air cylinder piston rods and machine components.

Designated Model 3000, the check is reported to provide a fully adjustable, opposed force to the movement of a machine element such as the feed on drill presses, lathes, saws, and other machine tools, for work holding devices, assembly fixtures, and production machines. The firm says that when the unit is applied to pneumatic cylinders as well as to hand fed machines, it prevents chatter or flutter and provides uniform feed that is uneffected by variations in power thrust.

Consisting of an oil filled checking cylinder, a checking piston adjustable metering valve and reservoir cylinder, the unit is installed by attaching the cylinder to a fixed portion of the machine and the piston rod to the member to be controlled. As the piston rod is pulled out, the piston in the checking cylinder forces oil through a specially designed metering valve and back into the opposite end of the checking cylinder. By externally controlling the flow of oil by means of the adjustable metering valve, the speed of travel of the piston rod and, hence, the machine element to which it is attached is controlled.

The Model 3000 is capable of handling loads up to 3000 lb and is available in 13 sizes with strokes from 2 to 20 in. Overall collapsed lengths range from 17 $^1/_{16}$ to 47 in. Cylinder bore is $^1/_{365}$ in. on all models and piston rod diameter is $^1/_2$ in. on models with stroke up to 6 $^5/_8$ in. on larger models.

—K–37

Speed Reducer

Introduction of a new Shaftex shaft-mounted speed reducer in sizes up to 40 hp and with nominal internal gear ratios of 5 to 1, 15 to 1, and 20 to 1 has been announced by Allis-Chalmers.

The unit is completely enclosed for direct mounting on the driven shaft and is available in single and double reduction units. The firm says it can be adapted without disassembly to include back stops where reverse rotation is prohibited and overload releases for chokable conditions.

The reducer is usually driven by a fixed pitch diameter Texrope drive. Variable speeds can be obtained by using either stationary control or motion control Vari-pitch sheaves.

—K–38

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Electro-Hydraulic Valve

A line of lightweight, compact electro-hydraulic servo valves, designed to meet the requirements of aircraft and missile hydraulic servo systems, is now available from Pesco Products Div., Borg-Warner Corp.

The new valve design features fast response, low internal friction, minimum null shift, faithful reproduction of small input signals and insensitivity to variations in temperature and load or supply pressures. The valve is a proportional flow control unit. It operates on a dynamic continuous flow sensing principle made possible, the company says, by a unique flowmeter design.

Output flow of hydraulic fluid is linearly proportional to the amplitude of the electrical differential input signal. Flow type feedback control in the new unit permits relatively large power spool overlap, allowing larger spool clearances. This design configuration produces a high fidelity valve with dead zone held to an absolute minimum. Gain in the valve is reported constant despite variations in load and supply pressures.

The valves are available for rated flow capacities from $1/2$ to 7 gpm and can be designed for use with any required system.

It consists basically of a dry coil torque motor, a hydraulically balanced flapper type pilot valve, a four-way slide type power valve and a flow meter feedback loop.

Total envelope for each model in the line is approximately $2^1/_2 \times 2^1/_4 \times 2^3/_4$ in. and weight is about 11 oz. They will operate at ambient temperatures from -65 to $+450$ F and fluid temperatures from -65 to $+400$ F. Recommended fluids for use with the new valve are MIL-0-5606, MIL-0-8200 and MIL-0-8515. —K-39

Lay-in Wireways

Two new features designed to increase structural strength and prevent abrasion of wiring insulation from screws, have been incorporated in the hinged-cover and screw-cover lay-in wireways now being produced by Keystone Mfg. Co.

Full length flanges are now formed along the cover side of the wireway to assure greater structural strength and rigidity. Designed to give a firm support for fastening down the wireway cover, these special flanges are also said to help the wireways maintain their original size, and as a result, require a minimum of maintenance.

The metal on both sides of each screw hole is embossed so that, when installed, the ends of the screws are completely recessed between two smooth, beveled runners which protect wiring insulation from damage and abrasion, the company states. It reports that the built-in channels comply with U.L. requirements, yet eliminate the need for separate protective cover attachments which can often be knocked out of alignment and snag the wires. —K-40

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Booster Vacuum Pumps

Vacuum Equipment Div., F. J. Stokes Corp., announces a new series of mechanical booster vacuum pumps to operate at faster pumping speeds in the pressure range from 10 μ to 1 mm than other comparable units.

Model 1710 has a maximum pumping speed of 1050 cfm and is capable of an ultimate vacuum below $^1/_2$ μ. Other units in the new series are Models 1711, 1712, and 1713, with maximum pumping speeds, respectively, of 1250, 2900, and 5100 cfm. Larger units, with capacities up to 10,000 cfm, are currently under development, according to the company.

The new pumps are integrated two-stage pumping systems, built together compactly on a common base-plate. First stage is a Roots-type dry blower (with two intermeshing bi-lobed impellers) that acts as a supercharger for the second stage, a standard gas-ballasted Microvac rotary vacuum pump of the appropriate size. During initial rough pumping, the pump operates by itself. At the proper cut-in pressure, the blower commences pumping and the whole assembly becomes a two-stage pump. **—K-41**

Automatic Transporters

Automatic Transportation Co., has announced a new separate control to provide dynamic braking on its line of operator led industrial trucks.

The firm says dynamic braking provides faster, safer operation of the transporter when used on ramps or other inclined travel and in very narrow aisle applications where it is difficult to use the standard mechanical brake.

A separate control permits optional use of the dynamic braking. It may be adjusted to conform to individual job conditions and in no way interferes with the standard braking system, the company reports.

Dynamic braking is deceleration resulting from the dissipation of electrical energy produced by the truck's travel inertia the company explains. The energy is produced by the truck's traction motor functioning as a generator. **—K-42**

Utility Blower

A new utility blower is announced by Robinson Ventilating Co. The package unit is weather-tight with motor and mechanism protected by a steel enclosure.

Design and construction permits the use of an economical, open type motor which is fully protected from the elements, the firm reports.

It is fabricated from heavy gage steel and has heavy duty split pillow block ball bearings. The new unit can be supplied in sizes to accommodate volumes from 650 to 16,000 cfm. Type J fan blade sizes range from 12 to 27 in. **—K-43**

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Large Motor Bases

Three new sizes of tension control motor bases are available from American Pulley Co. for NEMA frame motors up to and including 100 hp.

The all steel mountings automatically control belt tension and eliminate belt slippage and speed losses at peak loads, the firm claims.

Each of the three new sizes consists of a cradle-type motor base supported on built-in slide rails with screw take-up. A simple lateral adjustment is provided for belt alignment. The cradle is pivoted in ball-and-socket self-aligning bearings for free movement without danger of freezing or binding. The three motor bases, designated the Econ-O-Matic 9K, 11K, and 13K, take NEMA motor frame sizes up to No. 405, No. 445, and No. 505, respectively. —K-44

Pump Motors

Heavy-duty pump motors for application in domestic, industrial, and agricultural fields have been introduced by the Electric Motor Div. A. O. Smith Corp.

Vertical hollow shaft motors from 1 to 700 hp are offered, and feature heavy solid cast iron frames, sealed bearing chambers, metered oil flow and dual end ventilation. Vertical solid shaft motors are available in the full range from 1 to 800 hp, with built-in excess thrust capacity.

The jet pump motor line, 1/3 to 2 hp, features the firm's exclusive totally enclosed end-mounted starting switch, uniform windings and controlled ventilation.

Horizontal fractional hp motors, single and polyphase, in more than 2000 standard variations are offered. Close-coupled pump and C face motors from 1/3 to 150 hp are designed to cut installation costs. —K-45

Pipe Insulation

Owens-Corning Fiberglas Corp. has announced the availability of a completely fire-resistant pipe insulation.

Factory-applied around the pre-molded and incombustible Fiberglas pipe insulation, FRJ (flame retardant jacket) is described as a unique type of vapor barrier jacket composed of foil and kraft paper bonded together with a flame-extinguishing adhesive and reinforced with strong Fiberglas strands. It is manufactured under the brand name of Pyro-Kure by the American Sisalkraft Corp.

The new jacket also is a multipurpose barrier material that when applied to pipe insulation can be used as a jacket for all types of hot or cold piping up to 400 F, the firm states. When the temperature surrounding the material reaches the combustion stage, gases or vapors are released which tend to smother the flame. The company says water or weathering conditions have little or no effect on the flame extinguishing properties and the adhesive will not melt or run. —K-46

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Hydraulic Valves

Automatic Valve Systems Co. announces that temperature range of its automatic valve has been extended by a newly developed, heat resistant diaphragm material.

Valves equipped with the new material may be used in continuous service at temperatures up to 250 F, the firm reports. They are hydraulically activated, remote control and feature a unique, backless design. The valve disk that opens and closes the valve is an integral part of the diaphragm assembly. No lubrication or packing is required.

The valve is closed by hydraulic pressure applied to the valve cover through a small control tube. Generally, the firm states, this control pressure is derived directly from the process stream itself, with the main line tapped at some point up-stream of the valve inlet.

The valve is opened by releasing this pressure, allowing the line pressure to lift open the diaphragm and disk. Small, three-way pilot valves, manually or automatically activated, are used to apply or release the pressure in the control tube. **—K-47**

Electric Lift Trucks

Yale Materials Handling Div., The Yale & Towne Mfg. Co. has added a 5000 lb capacity model to its K51W line of very short overall length trucks.

Introduced in capacities of 3000 and 4000 lb, one of the K51W line's primary features is the trucks' ability to operate in aisles less than 10 ft in width, the firm states.

The 5000 lb truck is $73^3/_4$ in. form the rear of the counterweight to the face of the forks and can right angle stack comfortably in an aisle measuring 10 ft, 4 in. in width.

The new higher capacity model is designed with the same high speeds of travel and lift as the lower capacity trucks. Lifting speeds are 45 to 50 fpm unloaded and 25 to 30 fpm under load. Unloaded travel speed is 6 to $6^1/_2$ mph, loaded is $5^1/_2$ to 6 mph. **—K-48**

BUSINESS NOTES

Valve Company Sold

Purchase of Norwalk Valve Co., South Norwalk, Conn. is announced by Eclipse Fuel Engineering Co., Rockford, Ill. The 80-year-old Connecticut firm has been a manufacturer of gas pressure and control equipment.

Included in the purchase were all the machinery and the complete product line consisting of Norwalk and Connelly valves, regulators, governors, filters, and gages.

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Hydraulic Valves

Air Associates, Dallas branch, is now a full stocking distributor of Republic hydraulic valves for every industry, including globe, needle, selector, plug, check, and relief valves.

Opens Repair Plant

Westinghouse has opened its first overseas maintenance and repair plant for industrial electrical equipment with the dedication of a new 10,000-sq ft facility at San Francisco, south of Maracaibo, Venezuela.

The new operation, Taller Servicios de Occidente, is designed to provide faster and more efficient service to the Venezuelan oil industry and other large users of electrical equipment. Modeled after similar plants in the United States, it has facilities for the repair of motors and controls, generators, gas turbines, transformers, and other apparatus.

LATEST CATALOGS

Heavy Duty Spindles

Pope Machinery Corp. has issued Bulletin S-17, illustrating and describing belt driven and motorized heavy duty milling spindles.

Covered in the bulletin are P12000 series, belt driven, in sizes from 1 to 50 hp with standard 10, 20, 30, 40, 50, or 60 milling machine noses, and P2500 series, motorized, totally enclosed, fan-cooled, from 1 to 100 hp. **—K-49**

Belt Puller

Transall, Inc., has published a bulletin illustrating and describing its belt puller for use in installing and repairing conveyor belts.

The unit, available in two models, is designed to be used without nuts or bolts and has curved contact surfaces that will not damage the belting. The firm says the unit eliminates the danger of belts' slipping and causing injuries. **—K-50**

Power Cylinders

Data available from Miller Fluid Power Div., Flick-Reedy Corp., lists factors for the selection of power cylinders for specific applications.

Some factors relate to operating conditions; others involve cylinder design and material considerations. Shock loads due to rapid valve cutoff, decompression shock, amplitude and duration of shock, rate of pressure rise and fall, inertia forces from rapid acceleration and deceleration, and effect of rapidly discharging accumulators are some of the operating conditions listed. **—K-51**

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Servo System Components

Oilgear Co., Servocontrol Div., has introduced a new line of electrohydraulic servo system components. They are described in four bulletins.

Bulletin 36100 illustrates and describes the construction and principle of operation of plunger-less valve design. Bulletin 36200 covers specifications, capabilities and operation of a universal type amplifier. Bulletin 36300 illustrates construction and specifications of preset units. Bulletin 36400 illustrates different forms and types of custom-built amplifier and control panels for operating electrohydraulic servo systems. **—K-52**

Quality Control Facilities

Illinois Gear & Machine Co., has issued Bulletin 26 IG, an illustrated brochure on the company's products, plant facilities, quality control facilities as well as information on capacities, types, processes, materials, heat treatments, equipment, etc. **—K-53**

Thermal Relief Valve

A new data sheet containing detailed information and specifications for the new, leak-proof miniature thermal relief valve, has been published by Fluid Regulators Corp.

The firm reports that the small-sized, lightweight unit relieves excess pressures caused by thermal expansion of fluids in a closed system. The standard valve has no external leakage at 20 psi. External leakage is zero at all pressures. Cracking pressure is 30 ± 4 psi. Capacity is 3.5 gpm. Temperature range −65 to +280 F. Weight is under one ounce. **—K-54**

Whiteprint Equipment

A 16-page guide to whiteprint equipment and their various applications is offered by Ozalid Div. General Aniline and Film Corp.

The booklet includes product photos of the latest equipment and a list of specifications for each model. Each model is described in terms of its particular advantages, applications and distinguishing features. **—K-55**

Reducing Valve

A catalog sheet available from Atlas Valve Co., describes its Fig. 1910, Type E reducing valve for initial pressures to 300 psi with gas, oil, or water.

Outlet or regulated spring ranges are 5-35, 20-60, and 40-90 psi. Made of cast iron with bronze and steel trim, the valve is of single diaphragm, single seat construction and is claimed to have the largest capacity of any valve of its type. The valve is also made with a reverse seating arrangement to operate as a relief valve. **—K-56**

For Consulting Engineers

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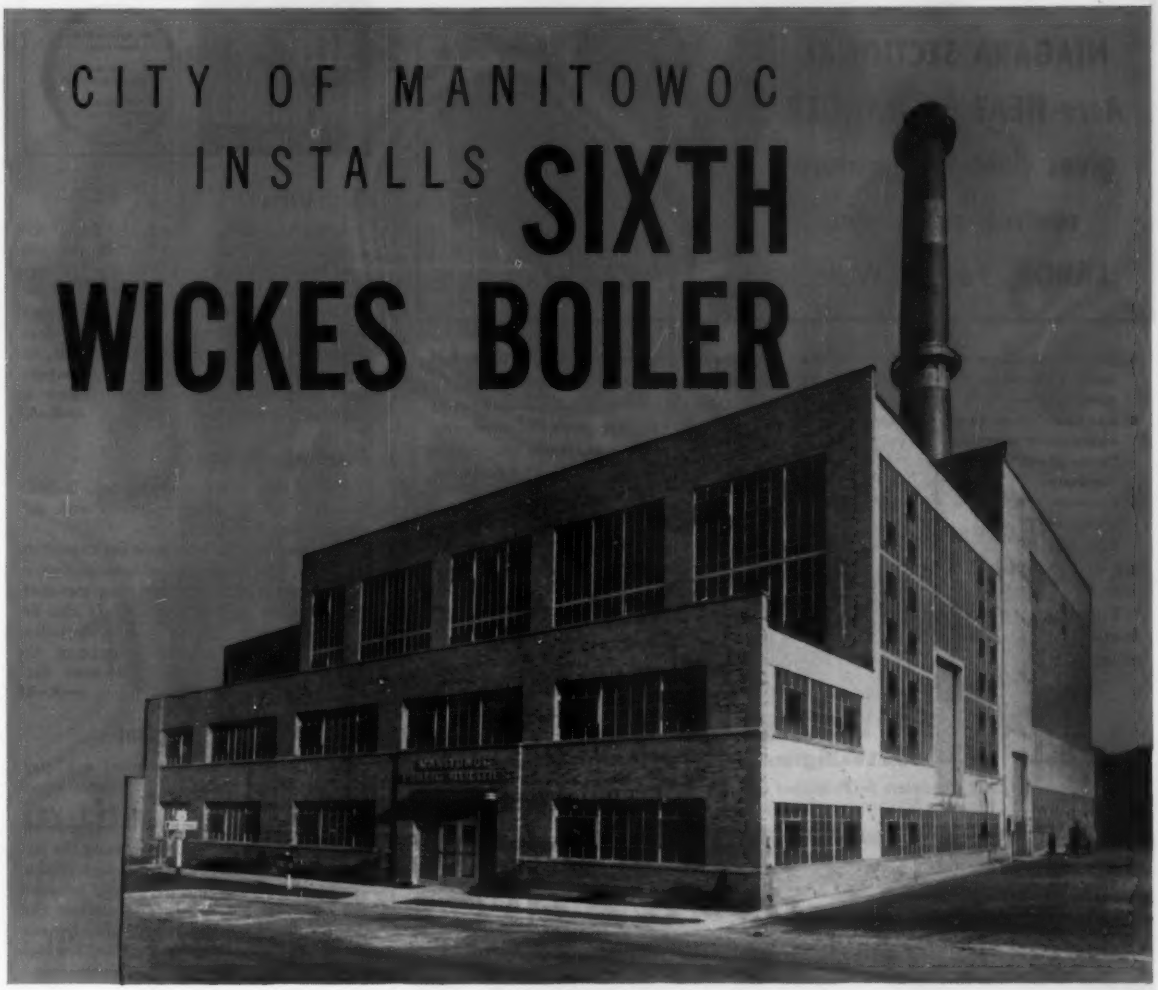

R. E. Cannard—Chief Engineer and General Manager

Manitowoc Public Utilities Commission has just installed the sixth Wickes Steam Generator to help provide power for the City of Manitowoc, Wisconsin, and its surrounding area. The continued selection of Wickes equipment by this progressive municipality is a tribute to the dependability and quality of Wickes Steam Generators.

Wickes Boiler Co. builds steam generators for all branches of industry . . . for municipalities and for private and public buildings. Wickes units are available in sizes up to 500,000 lbs. of steam per hour and are designed for high or low steam pressures and temperatures, and for all types of fuels and firing methods. There is a Wickes design available for your needs.

Write for bulletin 55-1, showing the wide variety of designs and sizes available in both field-erected and shop-assembled* steam generators, or ask the nearest Wickes representative to call on you for full information.

***For the latest developments in shop-assembled boilers, investigate Wickes natural circulation A-type water tube units now built for capacities up to 75,000 lbs. per hour for oil and gas fuels. Request bulletins 56-1 and 57-1 for full information.**

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Flush Valve

A new one-piece, botton outlet flush valve is described in Data Sheet No. 42, available from Pfaudler Co., Div. of Pfaudler Permutit Inc.

The new valve features one-piece glassed head and xtem, with glass-filled Teflon seat. Glassed surface is resistant to all acids, except hydrofluoric, even at elevated temperatures and pressures, and to alkalies at moderate temperatures. **—K-57**

Diaphragm Pumps

Milton Roy Co. has published Bulletin No. 1157 on its metering pump with diaphragm liquid end.

The two-page bulletin specifies capacities, pressures, and materials of construction of the leakproof pump for metering corrosive, obnoxious, or toxic chemicals. It also describes features of the pump, including mechanical actuation for correcting the volume of hydraulic fluid between each stroke. **—K-58**

High Frequency Equipment

Louis Allis Co., has published a 12-page bulletin, No. 2250, on high frequency equipment.

The bulletin points out the value of the equipment as a means of increasing the output or efficiency of present-day high production machinery that is often limited by standard 60 cycle power. It also stresses that drive motors operating at above-line frequencies can be built smaller, lighter and are often less expensive than standard drivemotors. **—K-59**

Laminated Plastic

A new catalog on its S-52 laminated plastic is announced by Formica Corp.

The catalog lists specific test information and provides photos to show that S-52 dies are faster and more economical to make, ighter in weight, and can be finished to a smooth, dent-resistant finish. It is claimed that Formica is stronger than steel on a strength to weight ratio. **—K-60**

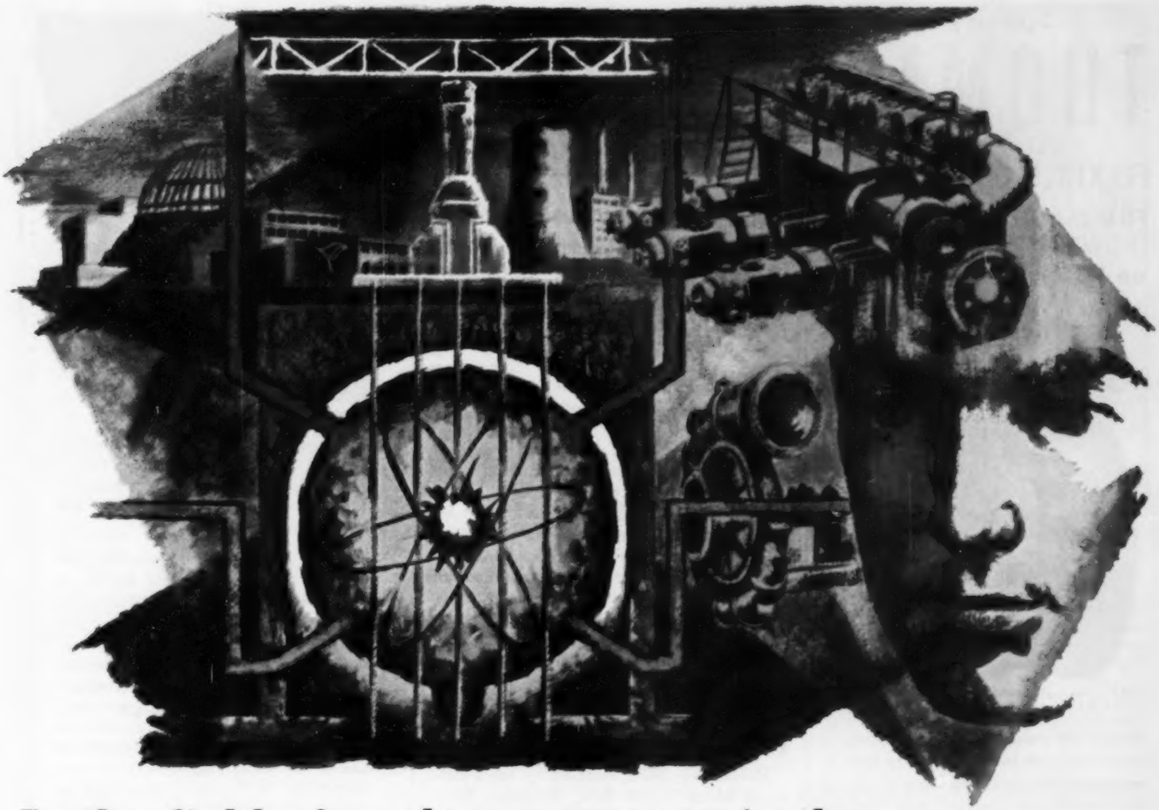
Special Charts

Bristol Co. has released Bulletin Y1906, describing charts for special requirements (including pre-printed photo charts for oscillographic recording). Engineering information and chart samples are included. **—K-61**

High-Speed Printer

A new folder describing the Univac high-speed printer, which prints data processed by the large-scale system, has been announced by Remington Rand Div. Sperry Rand Corp.

The machine operates at speeds up to 600 lines a minute, printing numbers, letters, and punctuation marks on a line 130 characters wide. A special fast-feed feature advances the paper rapidly over areas where no printing is required. **—K-62**



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Stainless Steels

A technical data folder published by Tubular Products Div. Babcock & Wilcox Co. contains technical data on analyses, corrosion and oxidation resistance, high and low temperature characteristics, physical and mechanical properties of the family of 18-8 stainless steels. —K-68

Piston Rod Deflections

Data on piston rod deflections is covered in a table with descriptive information available from Miller Fluid Power Div., Flick Reedy Corp.

The table gives, in inches, the deflections of ordinary commercial piston rods of horizontally mounted cylinders at center of span. Twelve different rod diameters, ranging from $\frac{5}{8}$ to $5\frac{1}{2}$ in. in diameter, are covered. Normal rod sags shown for each rod diameter in 3 to 24 ft lengths. The weight in lb per foot of length is also given for each rod diameter. —K-69

Precision Metal Parts

Publication BG-5, released by the Fabricated Metal Goods Div., American Brass Co. provides a source of unique ideas for the design and redesign of small precision metal parts.

The booklet describes and illustrates parts designed for low-cost production on multiple-plunger and progressive-tool presses, as well as stamping and deep-drawing equipment. Parts illustrated can be furnished in copper, brass, bronze, nickel silver, iron, steel, stainless steel, and aluminum. —K-70

Check Valves

A brochure with 40 photographs and cutaway illustrations, describing its line of bronze and iron body check valves has just been produced by Fairbanks Co.

The brochure shows the difference in construction of the two basic types of check valves which prevent return or backflow through pipe lines—swing check valves generally recommended for liquid service where full unobstructed flow or minimum resistance to flow is desired and lift check valves superior for service on steam, air, gas, or vapor lines because of their more positive action. —K-71

Plate, Sheet Fabrication

Littleford Bros., Inc. announces the publication of a catalog covering its operations in the fabricating field.

Items covered include tanks, housings, panel boards, weldments, bases, power plants, machine pans and guards, and special shapes and forms built to specifications. Types of plate and sheet metal include carbon steel, aluminum, stainless steel, monel, nickel, inconel, clad metals, and alloy metlas. —K-72

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Rims, Wheels, Tools

A 94-page, multi-purpose catalog of pictures, information and engineering data on Goodyear Tire & Rubber Company rims, wheels, tools and rim accessories has been issued by the firm's Metal Products Div.

Text includes information and pictures on rim research, step by step procedure for mounting and demounting rims, and operating instructions for using hydraulic tools. **—K-73**

Crank Presses

Bulletin 64, covering the firm's redesigned and expanded line of straight side single and double crank presses, has been announced by Niagara Machinery Tool Wks.

The 44-page catalog contains illustrated information on operating and structural features, including all-steel frames, box-type welded steel slide, laminated, nonmetallic ways, low inertia pneumatic friction clutch and brake, concealed driving mechanism; centralized pressure lubrication, operating controls and optional equipment. **—K-74**

Acid Resistant Alloy

Technical Bulletin No. 8 describing Aloyco 20, a special austenitic stainless steel recommended for valving sulfuric acid and other severely corrosive liquids, is available from Alloy Steel Products Co. Inc.

Cross-sectional views show the valve designs available. A graph illustrates the strengths and temperatures of sulfuric acid in which the alloy may be used. **—K-75**

Rotary Compressors

A four-page bulletin describing its new 365 rotary portable air compressor has been published by Le Roi Div., Westinghouse Air Brake Co.,

The bulletin, No. P-121B, illustrates features of the 365RD2, which the manufacturer claims to be the slowest running (1100 rpm) 365 cfm on the market. General specifications are included. **—K-76**

Air Motors

Ingersoll-Rand Co. announces a bulletin featuring more than 100 popular air motors in its line.

The units cover a power range from 0.3 to 24 hp, with speeds running from 50 to 2580 rpm at rated horsepower. Both multi-vane and piston motors are listed with specifications and dimension drawings. **—K-77**

Precision Components

A four-page brochure describing and illustrating its standard line of precision components for computers, instruments, and control systems has been published by Ford Instrument Co.

The brochure provides specifications and performance data on cams, synchros, mechanical differentials, oldham couplings, and 10-w low-inertia servo motors. **—K-78**

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Centralized Control Systems

Bulletin 106 illustrating and describing the design approach, materials, construction and modern facilities used in manufacturing a variety of centralized control and data presentation systems is available from Panellit, Inc. **—K-79**

Test Plugs, Connectors

A 16-page catalog and manual describing equipment and methods for sealing openings for pressure testing, has been published by Mechanical Products Corp.

The Quick-Seal line of test plugs and filling connectors is shown. **—K-80**

Engineering Research and Development

A 16-page illustrated brochure describing its research and development activities produced by ALCO Products, Inc. details the company's research and development organization and its personnel stressing the projects undertaken by the company for government and industry.

It also contains biographies of key members of the research and development staff.

The Schenectady laboratories described in the brochure include the nuclear criticality facility, radio-chemical, mechanical development, welding, thermal, chemical, metallurgical, and computation sections. **—K-81**

Processing Pumps

Twenty sizes of Ingersoll-Rand's new K line of motorpumps are outlined in the firm's new eight-page bulletin, Form 70022.

The pumps are offered in sizes of 1/4 through 25 hp for heads to 190 ft and capacities to 775 gpm. They are designed for food processing plants, beverage plants, general manufacturing plants and buildings, air conditioning equipment, coolers, evaporative condensers and dairy equipment. **—K-82**

Relief Valves

Fluid Controls, Inc. has announced publication of four new catalog sheets containing revisions on differential piston type relief valves.

The valves, which are designed for pressure relief in critical hydraulic circuits where failure would be hazardous to personnel, are externally adjustable and capable of handling pressures from 100 to 5000 psi. These sheets contain dimensional information and pressure vs. flow characteristics for the various sizes and models available. **—K-83**

Rotary Vacuum Dryers

Major design features of rotary vacuum dryers are described in a four-page catalog, No. 610, published by Vacuum Equipment Div., F. J. Stokes Corp.

The catalog lists the practical working volume capacities, heating surface areas, dimensions, and weights of the eight standard dryer models in the line. **—K-84**

Flexible Shafting

F. W. Stewart Corp. has issued a new bulletin on its circle Ess flexible shafting.

It explains briefly the advantages and the simplicity of designing a flexible shaft into products having an application which requires control from remote places. Included are specification charts on both remote control and power drive cables plus data charts of the firm's casing materials. **—K-85**

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Finger-Flexible Hose

A bulletin on its 400 finger-flexible Teflon hose for industrial and aircraft applications has been made available by Titeflex, Inc.

Specifications and ordering instructions are given in illustrated form, along with a performance chart for the hose. The bulletin also lists applications, and points out the large-diameter features, wide temperature range, light weight and resistance to corrosion of the hose. **—K-86**

Ceramic Transducers

Publication of a technical brochure on the subject of a new series of Glennite high temperature, piezoelectric ceramic transducers, is announced by Gulton Industries, Inc.

Described in the brochure are the exceptionally high Curie points of these transducers, that have made it possible to reach higher output voltages per unit input pressure than can be reached with conventional ceramics. Because no cooling is required, applications for the transducers highlight uses in ordnance systems and high temperature electromechanical sensors, the firm states. **—K-87**

Surface Grinding Machine

Brown & Sharpe has available a bulletin covering specifications of the all-new 618 Micromaster surface grinding machine designed for rapid production of highly accurate surface grinding of small and medium-sized work.

Specifications cover the three basic models of the unit with hydraulic and hand longitudinal and hydraulic and hand cross feeds; hydraulic and hand longitudinal and hand cross feeds; and hand longitudinal and cross feeds. **—K-88**

Stainless Steel Fittings

Dimensional data on its line of stainless steel welding fittings and flanges is contained in a revised catalog, TT600, available from Tube Turns.

Updated technical data for allowable S-values, allowable working pressures of fittings, pressure-temperature rating of flanges and corrosion resistance are contained in the 54-page booklet. Corrections have been made to reflect recent code changes and to conform with new code interpretations for Types 304L and 316L stainless steel. **—K-89**

Oscillating Conveyors

A 24-page book, No. 2744, issued by Link-Belt Co. covers the firm's lines of oscillating conveyors.

Ranging from the lightest to the heaviest capacities, the conveyors can handle material from 25 to 350 tph, and are available from stock. Product information on trough widths, depths, section lengths, accessories and selection and application data are included in the booklet. **—K-90**

Bronze Bars

A brochure describing a new line of 105-inch solid and tubular Continucast bronze bars has been released by Johnson Bronze Co.

The new long bar line is produced by a continuous casting method and supplements the firm's standard line of 13-inch bars. The folder outlines the advantages of the new long bar, gives typical physical properties, lists 21 sizes of solid bars from $^1/_2$ to 3 in. in diameter and 118 sizes of tubular bars from $^1/_2$ to $2^1/_2$ in. ID and from 1 to 3 in. OD. **—K-91**

For Classes III-IV (High Pressures) The "Buffalo" Type "BLH" Fan

For Classes I-II (Moderate Pressures) The "Buffalo" Type "BL" Fan

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For central system applications you don't have to accept a "compromise fan", loosely designed to cover any and all pressure requirements. "Buffalo" builds *two* fans, each engineered to fulfill specific pressure requirements to the highest possible degree. Brief engineering details on these "no compromise" "Buffalo" Fans are given below.

The "Buffalo" Type "BLH" Fan is recognized by engineers and contractors alike for its outstanding performance in Classes III and IV service. The "BLH" maintains an extremely high mechanical efficiency of 86% over a broad operating range. The smooth inlet bell with matching shroud, directional inlet vanes, backward-curved blades and divergent outlet all contribute to quiet operation and minimum turbulence. "Buffalo" engineering features, plus husky construction, add up to an efficient high pressure fan that will deliver long, faithful, maintenance-free service. When you plan a conduit system or other Class III-IV installation, be sure to specify the "BLH". Call in your "Buffalo" representative or write for Bulletin F-200.

The "Buffalo" Type "BL" Fan has gained wide acceptance for peak performance in major Class I and II installations throughout the country. Non-overloading, the "BL" provides quiet, stable, output from free delivery to shutoff. The smoothly-curved inlet bell, with directional guide vanes and matching shroud, assures minimum turbulence. Highest efficiency is attained by the streamlined wheel with backward curved blades, factory tested and balanced to hold vibration to an absolute minimum. The correctly shaped scroll of the wheel-contoured housing further contributes to smooth air flow. For full information on the rugged, reliable "BL" Fan for Class I and II conditions, contact your "Buffalo" engineering representative. Or, write direct for Bulletin F-104.

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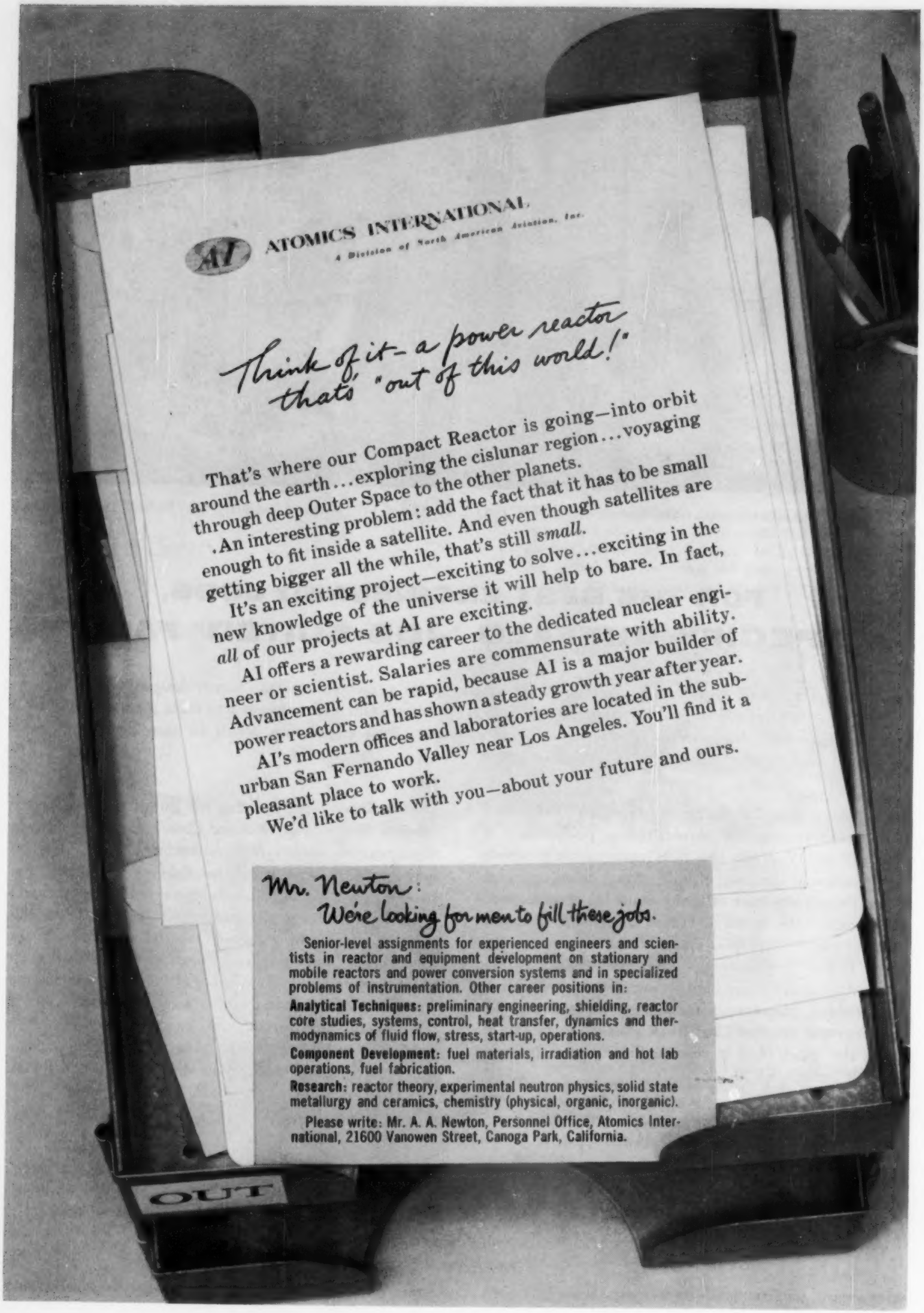

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OUT

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are prominently identified with achievements and inventions, which have not only benefited mankind but have made possible the enterprises in which so many are now engaged.

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THE American Society of Mechanical Engineers promotes Mechanical Engineering and the allied arts and sciences, encourages original research, fosters engineering education, advances the standards of engineering, promotes the intercourse of engineers among themselves and with allied technologists; separately and in cooperation with other engineering and technical societies, and works to broaden the usefulness of the engineering profession.

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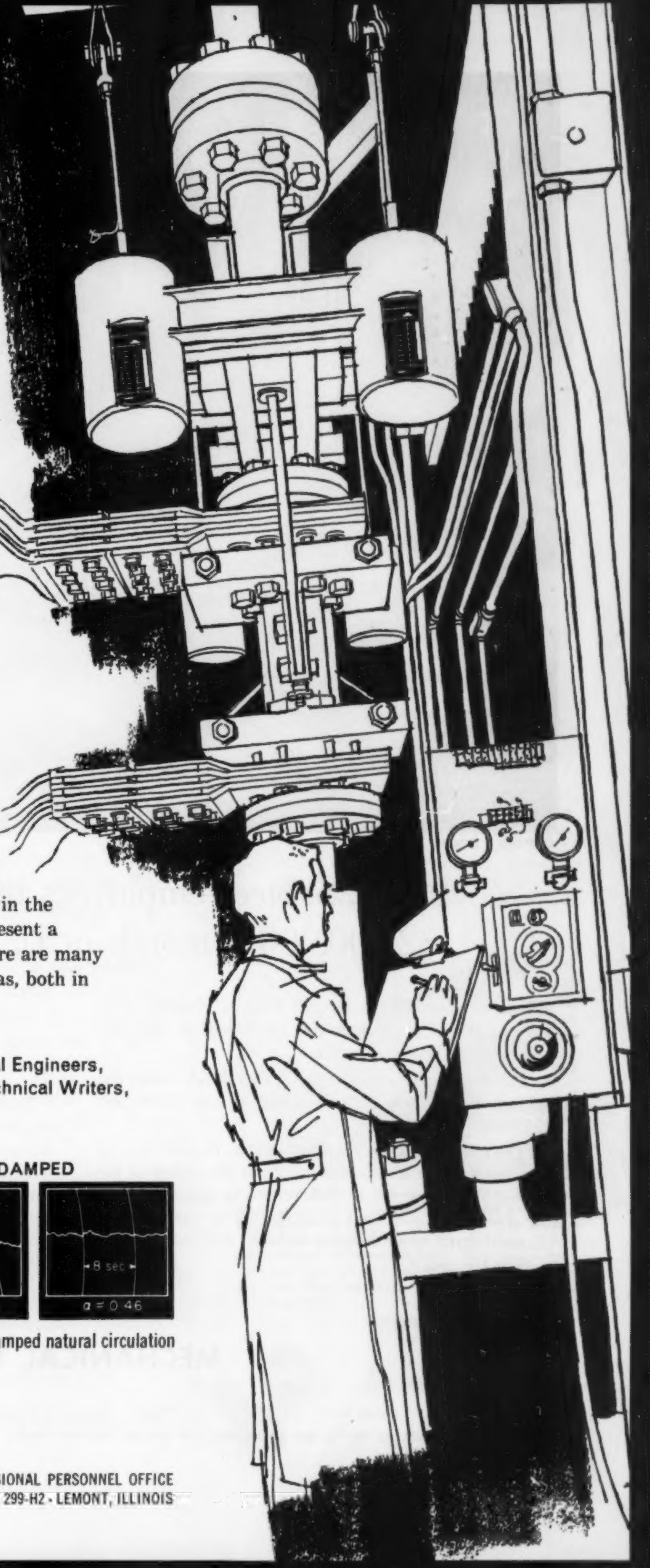
ME-1-59

HIGH PRESSURE BOILING STUDIES



An important part of the reactor development program is extensive research to obtain basic data on natural and forced circulation boiling systems. Such data is vitally needed in the design of full-scale central station boiling reactors. Engineers at Argonne are moving ahead into the new field of transient boiling along with its effect on boiling reactor performance and control at high pressures. New techniques such as the use of gamma rays to measure the transient density of steam-water mixtures are being developed. The needs in the reactor field are subject to rapid change and present a variety of challenges to research engineers. There are many opportunities at Argonne to work with new ideas, both in basic research and development.

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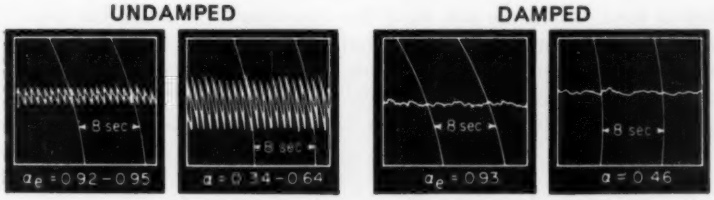

Steam volume fraction recording during undamped and damped natural circulation

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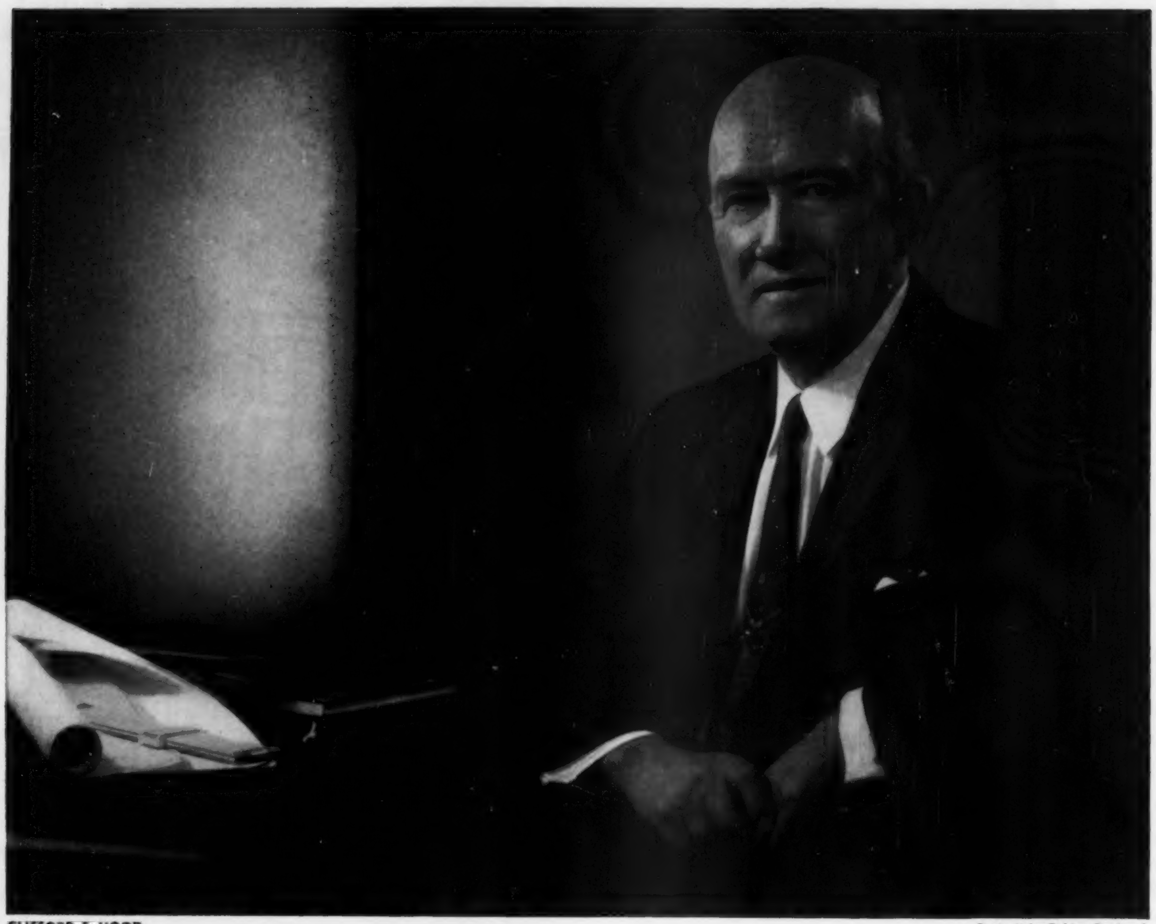

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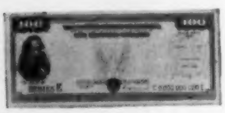

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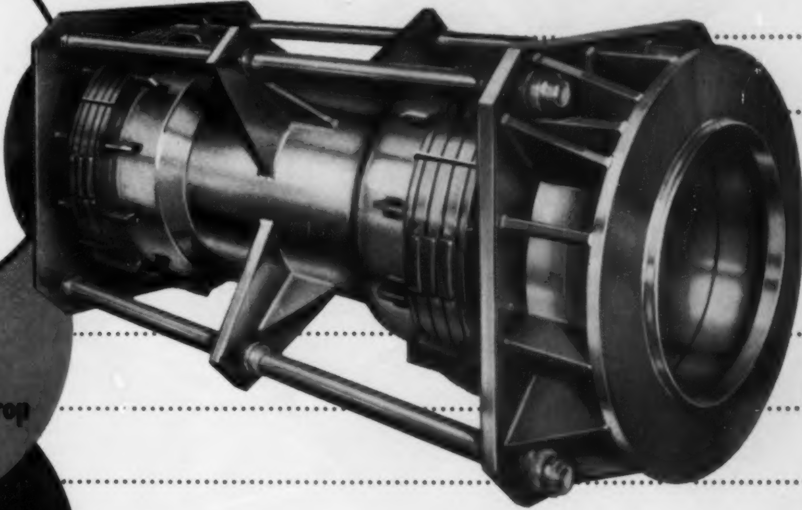


CORRUFLEX®

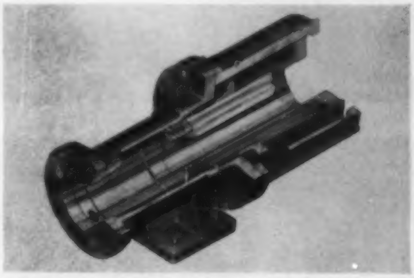
PACKLESS EXPANSION JOINTS

Designed for a 30" diameter high pressure, high temperature service line in a southwestern aircraft and missiles engine test center, the Adsco CORRUFLEX Self-equalizing stainless steel Expansion Joint shown above is one of many custom-designed units in service.

Adsco CORRUFLEX Expansion Joints are manufactured in sizes of 3" or larger, designed for specific line conditions. These units provide maintenance-free, trouble-free service.

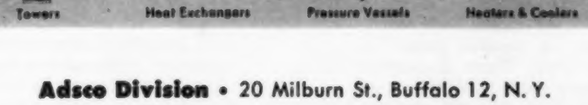
Every possible combination of pipe motion can be fully compensated for – absorption of axial motion, lateral deflection and angular rotation – with one or more standard or custom-engineered CORRUFLEX packless joints built by Adsco.

For complete engineering data write for your copy of the new CORRUFLEX Expansion Joint Bulletin, No. EJ-59-50 on your company letterhead.



ADSCO Piston-ring Slip-type Expansion Joints are world renowned as the only joints which can be unpacked and completely repacked without shutting down line pressure. As the *only* manufacturer of both slip and packless expansion joints, Adsco recommends the proper type which is best suited to the demands of the job – your assurance of complete satisfaction, utmost economy.

Yuba builds a wide range of equipment for the chemical, petroleum and heating industries



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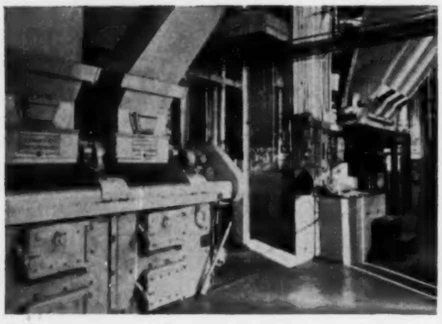
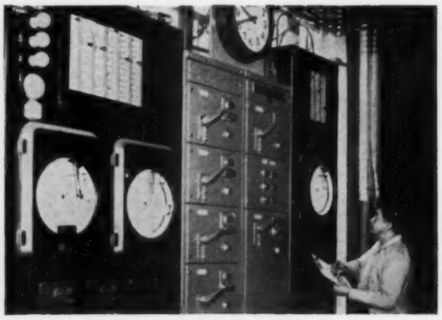
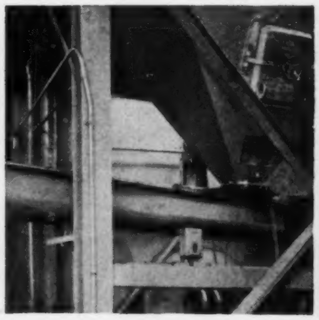


Firing aisle of Carlisle's power plant. Left foreground is new 20,000 lb/hr boiler by E. Keeler Co., fired by Detroit Rotostokers. In the rear is an Erie City Water Tube Boiler (equipped with Erie City Spreader Stokers), used as stand-by unit.



Close-up of control panel, by Hagan Corp. These controls—regulating furnace draft, steam flow, air flow, flue gas temperature, stoker control—constitute a complete, automatic combustion control system.



Fly ash is collected by this Prat-Daniel Mechanical Precipitator. Fly ash is gravity-fed from the hopper (at top of photograph) into completely-enclosed screw conveyor which moves it cleanly to the disposal point.

Carlisle Tire takes fuel costs for a ride

With increased fuel efficiency, Carlisle Tire and Rubber burns coal . . . holds costs to minimum while upping production 20%

At the Carlisle Tire and Rubber Division of Carlisle Corp., Carlisle, Pa., the steam produced by the power plant is used primarily for processing. As production of bicycle tires, inner tubes and other rubber products increased, the firm's engineering department decided to boost steam capacity with modern coal-burning facilities. Coal was used on the basis of cost—25% less than the nearest competitive fuel. The result has been a dependable steam supply, cleanliness of operation and a jump in operating efficiency. Today the plant consumes the same tonnage of coal as before modernization although production has increased 20%!

Coal is lowest-cost fuel

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To help you with fuel problems, the Bituminous Coal Institute offers a free technical advisory service. We welcome the opportunity to work with you, your consulting engineers and architects. If you are concerned with steam costs, write to address below or send coupon. Ask also for case histories booklet, complete with data sheets. You'll find them informative.

Consult an engineering firm

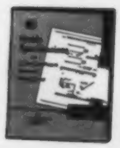
If you are remodeling or building new heating or power facilities, it will pay you to consult a qualified engineering firm. Such concerns—familiar with the latest in fuel costs and equipment—can effect great savings for you with the efficiency and economy of coal.

BITUMINOUS COAL INSTITUTE

Department ME-01, Southern Building, Washington 5, D. C.

Exterior view of Carlisle's power plant. From outside storage area, coal is moved to 32-ton bunker inside and fed by screw conveyor to coal hoppers. Coal handling system is by Jeffrey Manufacturing Co.

SEND COUPON FOR NEW "Guide Specifications for Underfeed Stoker Fired Low-Pressure Heating Plants." Heavy demand for the first edition of this booklet, adaptable for design loads 3,000 to 26,000 EDR steam, has justified an expanded edition covering application of underfeed stokers to firetube, watertube and sectional cast iron boilers. Complete specifications criteria cover all aspects of typical heating plant.



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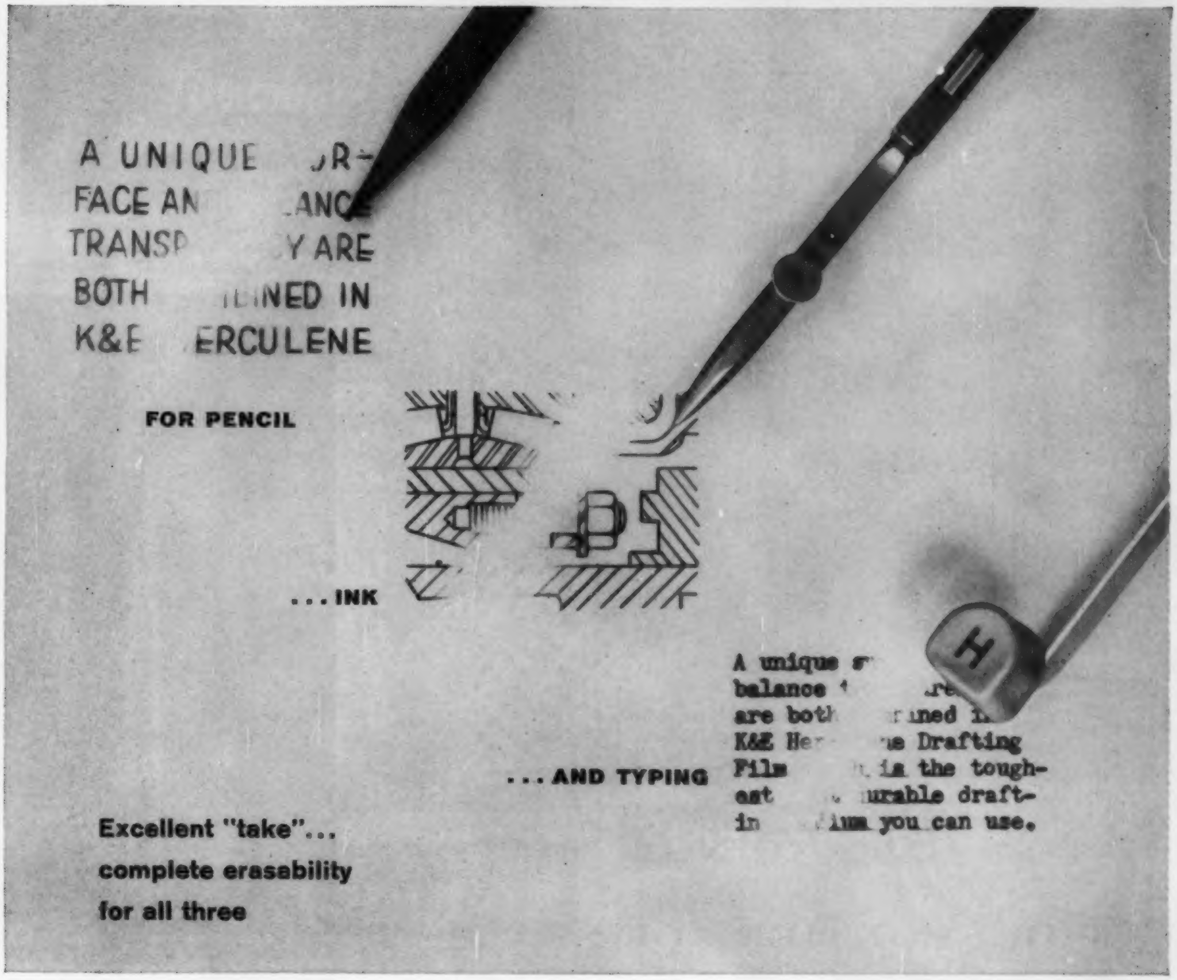

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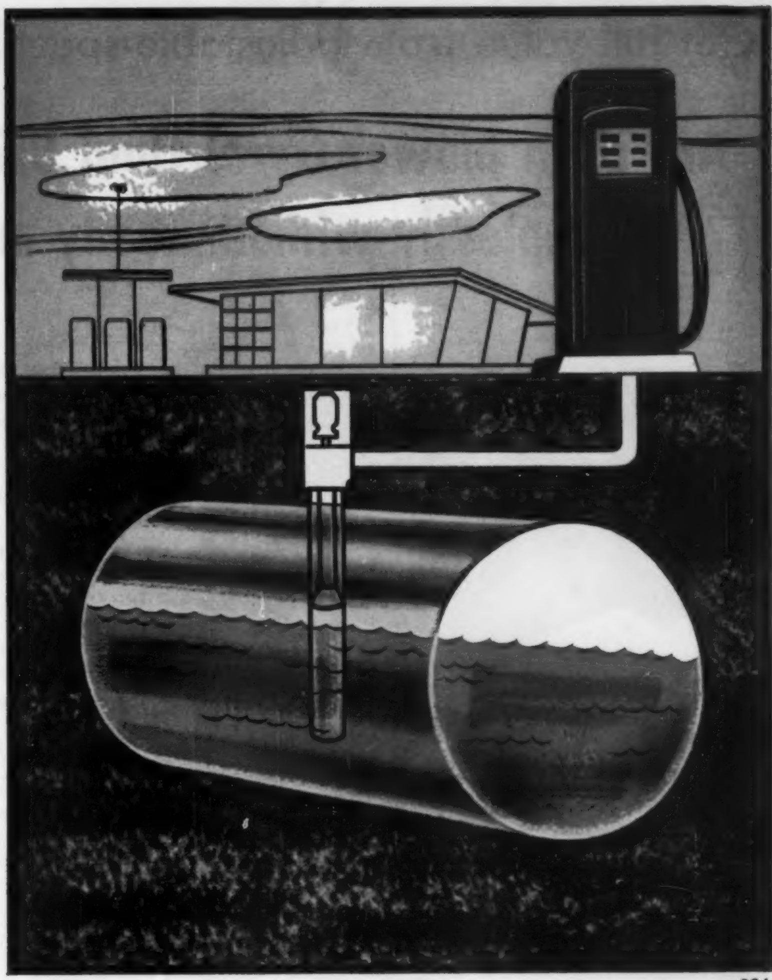

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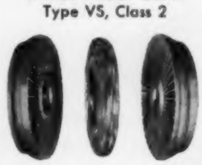
Feature	Shock Protection	Maintenance Record	Accuracy	Service Limit	Horsepower Rating
GÝROL FLUID DRIVE Type VS, Class 2 	Vortex of oil isolates shock.	Good—few wearing parts; extra-long service life.	Simple, wear-free speed control.	Unlimited—all Gýrol Fluid Drive ratings are for continuous service.	Units available up to 800 hp.
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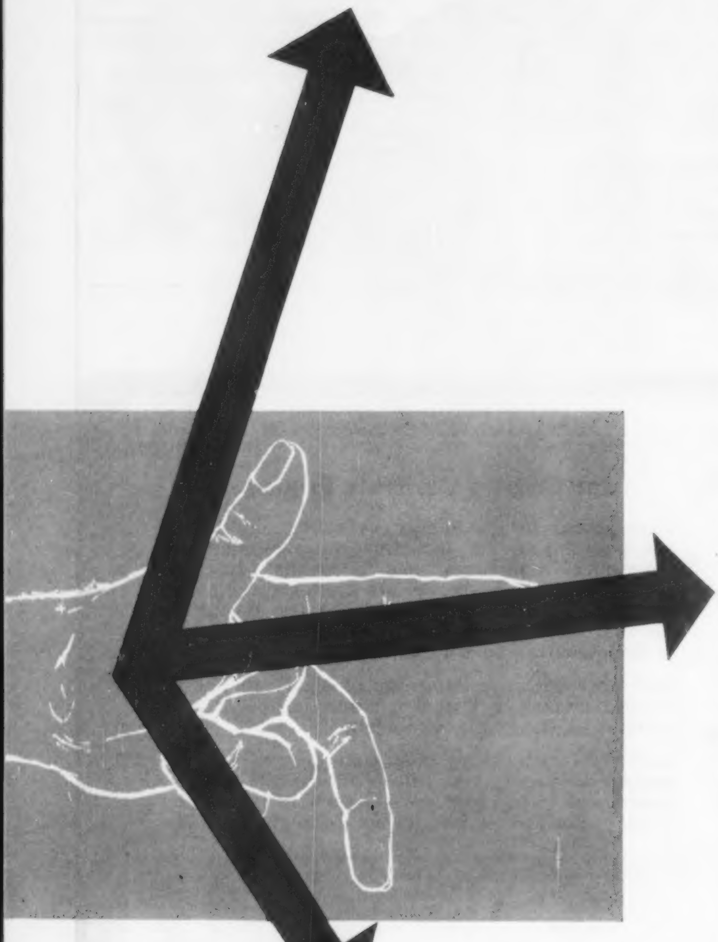

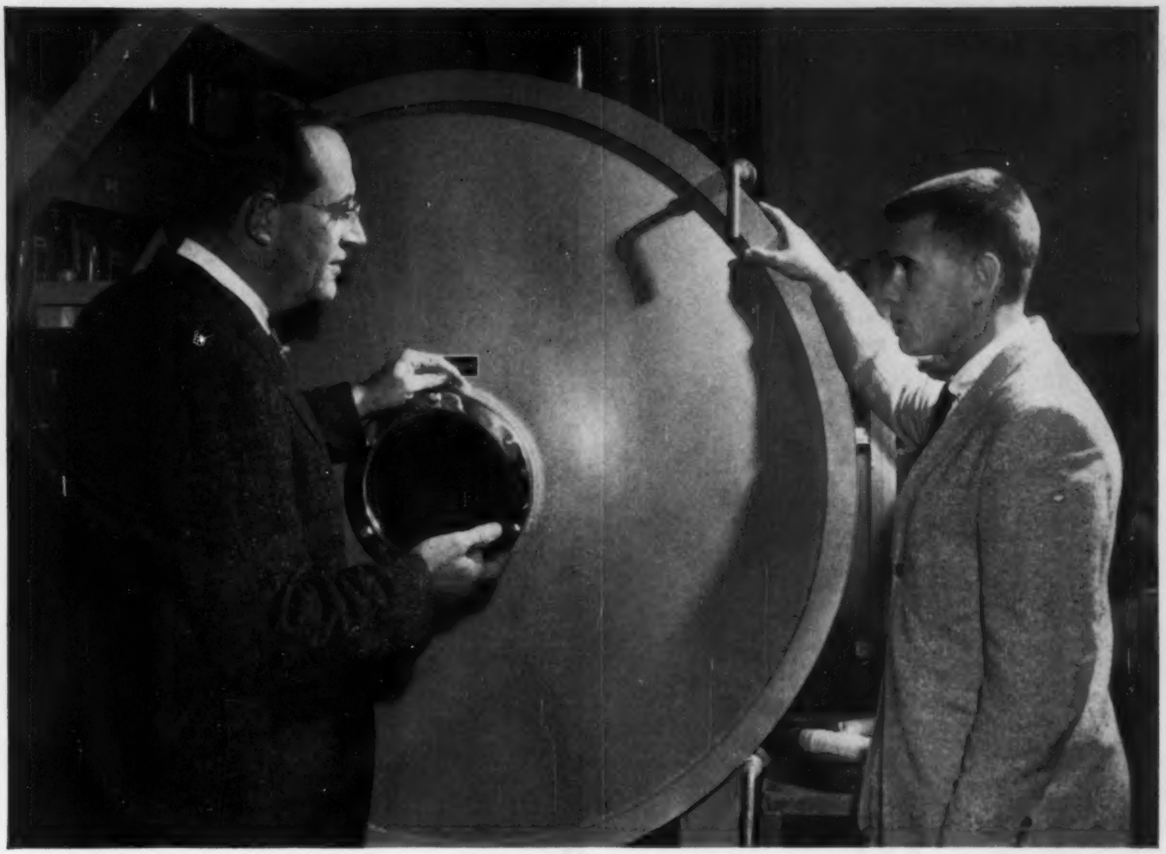

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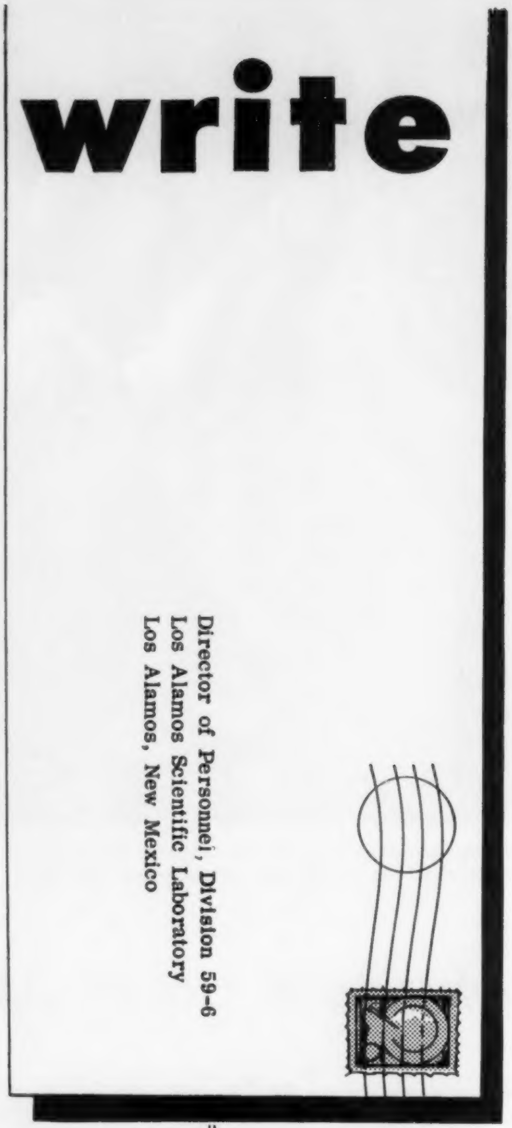

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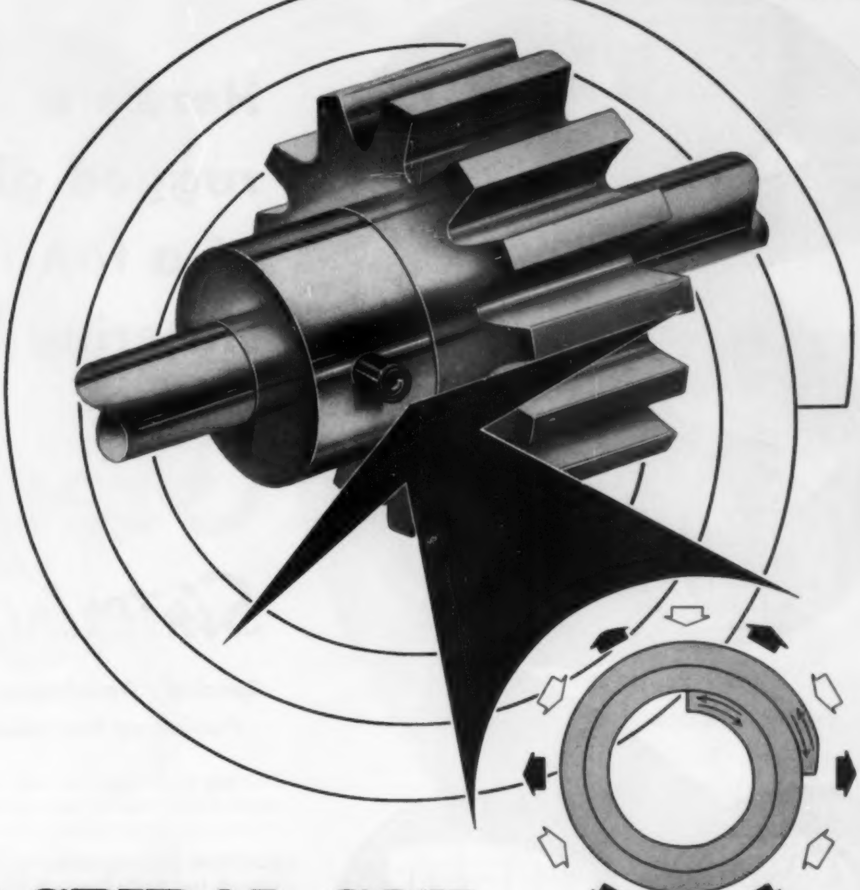

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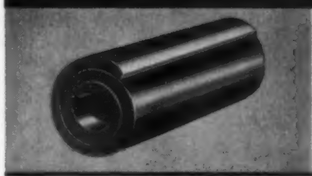

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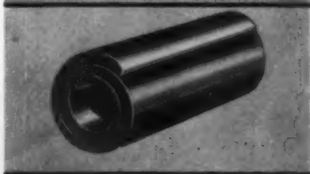

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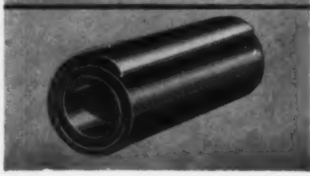

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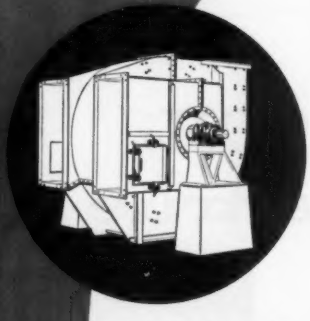

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